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ELECTRICITY IN AGRICULTURE.

It is a singular thing that, in spite of the fact that the first recorded uses of the electric motor on a practical scale were agricultural, so little has been done toward making electric power a regular and important adjunct in farming operations. If we remember aright, water was electrically pumped so long ago as the Vienna Exposition. The first practical demonstration of the electric motor was in electrical plowing and its earliest regular commercial use was in hoisting beets at sugar works. As time has gone on, however, something material has been accomplished, and an article by Mr. Williams elsewhere gives a vivid idea of the practical utility of electric power in the operation of great farms in the semi-arid territory of the United States. The great Western plateau, as our readers know, is a district of slight rainfall, yet the land is enormously fertile if properly irrigated, and in the States of Colorado and Wyoming agricultural prosperity depends mainly upon irrigation. The necessary conditions of water supply, as Mr. Williams states them, are certainly startling to the Eastern farmer. The natural rainfall of the northern Colorado district is, roughly, scarcely more than one-third of that which falls on the Atlantic slope, ranging in general from 12 in. to 18 in. It is, therefore, found that the rainfall must be reinforced by 1 in. to 24 in. in average depth of water supplied artificially.

Irrigation, however, possesses the great advantage that the water can be applied when it is needed and not when the clouds provide it. Irrigation work in Colorado is particularly difficult owing to the fact that the evaporation from open reservoirs is great, as much as 5 ft. to 8 ft. per year, and most of the distribution is through open ditches, seldom properly lined, so that the losses from seepage are great. The lands unirrigated have merely value for grazing purposes, but when properly supplied with water their value rises at least a hundredfold. As the farming and irrigation have increased the difficulties of supply have increased also, and at the present time water rights are of somewhat uncertain value. All through this arid belt, in which the rainfall is light and surface water somewhat uncertain, there is a large amount of underflow, which includes probably the greater amount of the water derived from the melting snows of the mountains and which can be tapped usually at 20 ft. to 25 ft. below the surface. Pumping water from the underflow has now become a very valuable method of irrigation, and of late the Northern Colorado Power Company has been making a well-directed and systematic effort toward the exploitation of electric power for the purpose of operating irrigating pumps. The work of obtaining water is now carried out with deliberate and scientific care. A series of drill holes are run down and

the cores carefully examined and tested to show the conditions in the strata which carry the underflow. The porosity of the ground in the nature of a flow is tested by drilling a group of holes and making an actual quantitative examination for the amount of water available from the flow, so that when the final well hole is put down the amount of water for pumping can be pretty well ascertained. In fact it has been found that the water supply in the underflow can be determined more precisely than the surface flow, since the conditions remain more uniform.

The Northern Colorado Power Company was formed for the special purpose of generating cheap energy in the lignite coal field and distributing it for irrigation, lighting and other power uses over a territory extending from Denver on the south to Cheyenne on the north and over a distance east and west of some 50 miles. The main power plant is about 15 miles from Denver, on the Colorado & Southern Railroad, in the center of the northern lignite field. The power is produced by turbo-generators in a plant taking its fuel practically directly from the mines and equipped with all modern appliances for its efficient utilization. The generating plant is 13,200 volts, three-phase, 60 cycles. For the main transmission 44,000 volts is used on the line with branches at 13,200 volts, 6600 volts or 2300 volts, as occasion may require. The system already built reaches thirty-two towns in the center of the richest agricultural district in northern Colorado. The lines are run on wooden poles, forty to the mile, with substations and switching stations about 20 miles apart on the main line, so arranged that any substation can be cut out without interrupting the service. All the territory covered has a copious underflow which can be tapped for pumping. The wells dug for irrigation are peculiar. They are either circular or rectangular in form with concrete curbings lowered down to the water-bearing strata. The pump is submerged and the vertical shaft carried up to a framing which either carries a motor with vertical shaft directly coupled or a pulley belted to a motor placed in a housing at the side of the well. The lift being but moderate, centrifugal pumps are used, driven by 2300-volt motors.

During the pumping season of 1910 careful tests were made on fifty-seven pumping plants with approximately the following results. With an irrigation plant arranged to supply a quarter-section of 160 acres lifting through a 25-ft. head the average investment required is $7.45 per acre. The cost of operation varies from $1.75 to $2.25 per acre-foot—that is, a foot of artificial rainfall can be obtained for this modest sum. Over much of the territory this additional foot is all that is required, although in other places 2 ft. might be necessary. Allowing 10 per cent as fixed charge on the pumping investment the ultimate cost to the farmer for an acre-foot amounts to only about $2.75. This is much lower than the ordinary cost of water rights and their maintenance, with the additional advantage that the water is always available just when it is needed. It is an interesting fact that the gain by this ability to regulate the time of flow to the condition of the crops has led to not a little pumping by farmers who already have water rights. Besides the use of electricity for pumping a considerable amount of auxiliary farm machinery is operated from these convenient power circuits, so that on nearly every farm that has a pump electric lamps will be found, motors for driving tools, for hoisting, for cutting feed and other incidental purposes. Still another and more interesting feature of the system is the fact that at last, after more than twenty years since the first experiments of Chretien and Félix, electrical plowing by the same method of cable haulage which they tried is now being experimented with. Altogether this power system is a most interesting and important development. The day of the old-time careless and reckless farming has passed and the era of intensive farming in our own country is approaching. The work of the Northern Colorado Power Company will prove to be only the beginning of the application of electricity to agriculture.

TURIN MEETING OF INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The Turin meeting of the International Electrotechnical Commission will mark an epoch in the history of international electrical engineering, owing to the importance of the decisions it has rendered, the unanimity of its resolutions and the magnitude of the work it has undertaken. In regard to its composition, it brought together more than fifty delegates from nineteen different countries, speaking eleven different languages, not reckoning dialects. Only two languages, however, French and English, were officially recognized and each delegate expressed himself in one of these. All the notices, records and resolutions had to be posted and maintained in these two languages. As to the decisions of the commission, the first great step has been the definite adoption of the $I = E/R$ as the algebraic international expression of Ohm's law. This has long been the approved expression in France, Italy, the United States and in other countries; but England and Germany have been exceptions to the rule, England having adhered to the symbol C for current and Germany to W for resistance. Now our British and German confrères have courteously given way for the sake of international uniformity, so that there is now only one authoritatively recognized method of writing Ohm's law all over the electrotechnical world. All other ways are either antiquated or irregular. This important agreement could not probably have been reached for many years without the aid of the International Electrotechnical Commission.

Next on the list are various other rules and symbols which have been adopted provisionally. That is, they have been definitely adopted, but subject to possible future amendments in detail, on the suggestion of a special international committee, which is charged with carrying on the work of symbol standardization and with reporting its findings and recommendations to the next commission meeting, at Berlin in 1913. Since, however, these adopted rules and symbols have been under consideration, without change, for more than a year already, it is not likely that they will be materially changed in the near future. Another very important decision is that in relation to alternating-current diagrams, or vector diagrams as they are commonly called. It will be remembered by those who use such diagrams that ever since 1887 there have been two

different schools of graphics on the subject; namely, those who, taking the hour hand of a clock at 3 p. m. as representing an impressed emf in an alternating-current circuit, used the minute hand at, say, 3:20 p. m. to indicate, with Fleming, a lagging current; and those who, on the contrary, used the minute hand at 3:10 p. m. to indicate, with Kapp, the same lagging current. For more than twenty years our electrotechnical literature has been as needlessly divided into opposed schools of graphical representation and thought as were the big-endians and little-endians, who, in Swift's memorable story, brought their country to the verge of civil war over the question as to whether boiled eggs on the breakfast table should be opened at the big or at the little end. Nor has the controversy been limited to electrotechnical literature in the English language. Nearly all of the languages of the civilized world have suffered in the dissension. At Turin, without a single dissenting voice, the resolution was speedily voted on the motion of the British committee to adopt the 3:20 p. m. method, which was originally imported into the literature of the science by Fleming, whereby also the impedance of a choking coil becomes expressed by $R + jx$, as distinguished from $R - jx$. If the commission had accomplished nothing else than this decision, we think that the trouble and expense of its organization would have been amply justified, so important is a unanimous, authoritative international decision on this vector question to electrotechnics.

The I. E. C. also undertook to call and assign all future international electrotechnical congresses, and, in particular, accepted with thanks the invitation received through its American committee from the American Institute of Electrical Engineers to have an international electrotechnical congress held at San Francisco in 1915, in connection with the Panama Exhibition at that time. This action was taken at the request of the Turin Congress of Electrical Applications and will result not only in greater uniformity of congresses, but also in their better organization. Heretofore in one and the same year a commission meeting might be held in one country and a congress in another. The permanent organization of the I. E. C. and its authoritative character, under the auspices of various governments and national electrotechnical societies, will aid in avoiding such unfortunate conditions in the future. President Dunn, of the American Institute of Electrical Engineers, and ex officio member of the United States national committee of the commission, extended the invitation on behalf of the board of directors of the American Institute for 1915. Meanwhile, a commission meeting is scheduled to be held at Berlin in 1913 and an invitation extended through the German national committee. In conformity with the suggestions offered in the retiring address of the commission president, Prof. Elihu Thomson, the important questions of international rating of machinery and international electrotechnical nomenclature are left in the charge of international sub-committees, which are to report at the Berlin meeting. A fairly full account of the proceedings of the Turin meeting will be found on another page. For its success much credit is due to the permanent officers of the commission, as well as to their Italian hosts and to the members of the American committee.

STUDIES IN LUMINOUS EFFICIENCY.

A recent paper by Buisson and Fabry, dealing in an interesting way with the amount of energy necessary to produce the unit of luminous intensity, gave results which bring up some rather curious considerations. Buisson and Fabry worked with a quartz mercury arc and determined the number of watts radiated per mean spherical candlepower in the case of each of the brilliant lines of the spectrum. The values which they found were as follows: For the green light 546 $\mu\mu$, 0.018 watt per candle; for the yellowish pair 578 $\mu\mu$, an average of 0.031 watt per candle, and for the bright blue violet line 454 $\mu\mu$, 0.31 watt per candle. Dr. Ives in a recent paper in these columns (June 15, 1911) computed for the highest luminous efficiency possible in monochromatic radiation 0.0154 watt per candle at the wave length of this green mercury line, a most satisfactory agreement with the figures just given, considering the difficulty of the investigation from every standpoint. In the rough, Dr. Ives' figures indicate a possible efficiency of 65 spherical candles per watt, while Buisson and Fabry obtained 55.5 spherical candles per watt for the green mercury light. If one could obtain anything like this figure in practice he could cheerfully forgive the unwonted color. Approximately two-thirds of the light of the mercury arc comes from this brilliant green line. The value obtained for the efficiency of the yellowish radiation by the French investigators seems rather lower than it should be, considering the position of this radiation on the normal luminosity curve, and suggests possible corrections due to the particular intensity of the light under investigation with a corresponding position of the maximum sensibility. At high intensity there should be no such difference between the green radiation and the yellowish as is here shown. The efficiency of the blue violet line, on the other hand, is quite nearly what would be anticipated. This line, however, contributes so little to the total illumination that the loss of efficiency ascribable to it is very small.

So far as the efficiency of the luminous radiation is concerned, therefore, the results reached by the quartz mercury arc would be something altogether startling in the way of luminous efficiency. In point of fact, however, while the light is among those of the very highest efficiency, it actually returns only some four or five candles per watt, instead of forty or fifty. The rest of the energy seems to be frittered away in various incidental losses—losses at the electrodes, losses due to heating the tube and still other losses in infra-red and ultra-violet radiations of the metallic spectrum. As the tube runs red hot in the commercial quartz mercury arc, probably by far the largest part of the loss is in long-wave heat radiation from the tube quite separate from any radiation due to the mercury spectrum by itself. It is only another example of the difficulty of utilizing substances which give discontinuous spectra as practical illuminants. They promise fair, and the visible spectra may give prodigiously encouraging results, and yet through specific infra-red radiation, as in the case of the helium tube, or through the incidental losses here mentioned in connection with the mercury tube, the net result falls far short of the theoretical mark.

Meeting of the International Electrotechnical Commission at Turin.

The meeting of the International Electrotechnical Commission, which was held at Turin, has been notable for the number of countries and national committees represented, the unanimity of its decisions and the technical importance of its resolutions.

The following is a list of the delegates who attended the meetings, government delegates being distinguished by an asterisk: President of the commission, Dr. Elihu Thomson. Belgium: MM. A. Halleux, G. A. L'Hoest, E. Gevaert and O. De Bast. British Indian government: Mr. F. H. Mears.* Canada: Prof. L. W. Gill. Denmark: Mr. S. A. Faber and Prof. Absalon Larsen. Ecuador: Sr. Richard Muller. France: MM. R. V. Picou, H. Armagnet, P. Boucherot, E. Brunswick, M. J. Blondin, Ch. David, P. Janet, F. Laporte, R. Legouez and G. Roux. Germany: Prof. Dr. E. Budde, president and secretary of the Verband Deutscher Elektrotechniker; Dr. Georg Dettmar, Geh. Ober Postrat and Prof. Dr. K. Strecker. Great Britain: Messrs. Alex. Siemens,* W. Duddell, Major W. A. J. O'Meara,* R. K. Gray, Dr. Silvanus P. Thompson* and P. F. Rowell. Holland: Prof. Clarence Feldmann, president of the Electrical Section of the Dutch Society of Engineers, and Mr. L. M. Barnet Lyon. Hungary: Prof. Dr. Moritz de Hoor-Tempes. Italy: MM. Prof. Luigi Lombardi, president of the Associazione Elettrotecnica Italiana; C. Clevici, Prof. G. Grassi, E. Jona, C. Montù and P. Verole. Japan: Prof. Dr. A. Oya. Mexico: Sr. Alfonso Costello. Panama: The consul at Turin. Portugal: The consul at Turin, Il Barone Nasi. Spain: Sr. Don Luis de la Peña. Sweden: MM. C. A. Rossander and E. C. Ericson. Switzerland: MM. C. Prof. J. Landry and K. Täuber. United States: Messrs. C. O. Mailloux,* Gano Dunn,* president of the American Institute of Electrical Engineers; A. E. Kennelly, C. H. Sharp. General officers of the commission: Col. R. E. Crompton, honorary secretary; Mr. C. le Maistre, general secretary, and Mr. E. Litton, assistant. Personally invited: Mr. Leon Gaster, honorary secretary of the British Illuminating Engineering Society and representative of the London Chamber of Commerce.

The total number of countries represented was nineteen, the number of delegates in attendance being fifty-one.

The first session on Sept. 7 was opened with an address by His Excellency Signor Calassano, Italian Minister of Posts and Telegraphs. This was followed by an address from the retiring president, Prof. Elihu Thomson.

Professor Thomson called attention to the large recent development of the commission as an international organization and to the rapid progress of its work. He pointed out that the settlement of the questions now pending before the commission was of very great importance to electrical engineers all over the world and that other questions of similar importance would no doubt soon call for consideration. He suggested the desirability of appointing small international sub-committees to carry on the work of the commission during the periods between the official meetings of different years.

Dr. E. Budde, the president of the Verband Deutscher Electrotechniker, was elected as president of the commission to succeed Dr. Elihu Thomson. The proposal emanated from M. Picou, the president of the French committee, and was unanimously adopted.

Four subjects were dealt with by the commission in the sessions of Sept. 8, 9 and 11. The sessions of the eighth and ninth lasted about five hours each day and were sessions for the unofficial discussion of the subjects. The official meeting on the eleventh was devoted to a formal ratification of the written decisions as reached at the previous sessions. The four subjects related to (1) international nomenclature; (2) international symbols; (3) international diagrams for alternating-current quantities; (4) international rating of electrical machinery and apparatus. The place and time of future meetings and the organization of future electrical congresses were also subjects of discussion.

These subjects had all been discussed to some extent at the preceding reunion of the commission at Brussels in August, 1910, and the questions under consideration had been placed before the various national committees in printed form about a year ago.

In brief, the action taken at the Turin meeting was definite on all four subjects. In relation to nomenclature, a list of international terms was adopted provisionally, the further pursuance of the subject being left to a small sub-committee. An international list of symbols was adopted provisionally, and the three symbols entering into the algebraical expression of Ohm's law were adopted definitely. Definite action was taken on the direction of phase rotation in alternating-current diagrams and the report of the Brussels conference in relation to international rating of machinery was adopted, a sub-committee being appointed to continue work upon the subject. In particular it was recommended that both the electrical power of generators and the mechanical power of motors should be expressed in international watts.

The following resolutions were provisionally adopted in regard to international symbols:

(1) Instantaneous values of electrical quantities which vary with the time are to be represented by small letters.

(2) Virtual or constant values of electrical quantities to be represented by capital letters.

(3) Maximum values of periodic electrical quantities to be represented by capital letters followed by the subscript "*m*."

(4) Magnetic quantities, constant or variable, to be represented either by capital script, gothic, heavy-faced or any special type.

(5) Maximum values of magnetic quantities to be represented either by capital script, gothic, heavy-faced or any special type, followed by the subscript "*m*."

(6) The following quantities to be represented by the following letters:

Electromotive force	E, e
Electric quantity	Q, q
Self-inductance (coefficient of self-induction)	L
Magnetic force	$\mathfrak{H}$
Magnetic flux-density	$\mathfrak{B}$
Length	L, l
Mass	M, m
Time	T, t

The following letters were definitely adopted for the international representation of the quantities entering into the algebraical expression of Ohm's law:

Current	I
Electromotive force	E
Resistance	R

The name "reactive power" was adopted for the quantity $UI \sin \varphi$ in relation to alternating-current circuits, U being the virtual potential difference, I the virtual current and φ the difference of phase.

In regard to alternating-current diagrams the following resolutions were adopted unanimously: In the graphical representation of alternating electric and magnetic quantities advance in phase shall be represented in the counter-clockwise direction. In consequence, the impedance of a reactive coil of resistance R, and inductance L, is $R + \sqrt{-1}\, L\, \omega$, and that of a condenser of capacity C is

$$\frac{1}{\sqrt{-1}\, C\, \omega},$$

where ω is equal to $2\pi \times$ frequency.

It follows also that the diagram herewith represents the phase relations in a simple alternating-current circuit containing an impressed emf *OE* and a lagging current *OI*.

It was decided that the next official meeting of the commission should be held at Berlin in 1913, an unofficial meeting, if needed, to be held at some intermediate date.

Mr. Gano Dunn, as president of the American Institute of Electrical Engineers, invited the commission to hold an official meeting at San Francisco in 1915, on the occasion of the Panama Pacific Exposition, to be held in celebration of the opening of the Panama Canal. He announced that the American Institute of Electrical Engineers was desirous of holding at the same time an international electrical congress, that the board of directors of the Institute had already passed resolutions authorizing the congress and had instructed him to appoint a committee of organization, provided that an expression of opinion favorable to the holding of such a congress was obtained from the commission at its meeting in Turin. The meeting thanked Mr. Dunn for the very cordial invitation of the American Institute of Electrical Engineers and adopted the following resolution:

"The International Electrotechnical Commission expresses its willingness to hold an official meeting at San Francisco in 1915, and instructs the central office, on the request of the American Institute of Electrical Engineers, to cooperate with it in the organization of an International Electrical Congress at San Francisco at the same time."

The unofficial meetings of the commission were ably presided over by Prof. Luigi Lombardi, the president of the Associazione Elettrotecnica Italiana. Mr. C. O. Mailloux, the president of the American committee, rendered valuable services at all of the sessions of the commission by acting as interpreter, not only between the official languages of the commission—English and French—but also between these and the German, Spanish and Italian languages.

The social events of the commission's visit to Turin were prepared with great care by the Italian committee. At one of the dinners a souvenir in the form of a picture was presented by a number of the delegates to Prof. Elihu Thomson in recognition of his valuable and highly recognized services to the commission as its president. The honorary secretary, Colonel Crompton, acted as master of the ceremonies on this occasion.

At a plenary meeting of the International Electrical Congress on Sept. 13 it was unanimously voted that the International Electrotechnical Commission should be requested to organize in the future all international electrotechnical congresses, so far as concerned their dates and places of meeting, the details of the organization being referred to the national committee of the country in which the congress is to be held, and through such committee to the local national electrotechnical bodies.

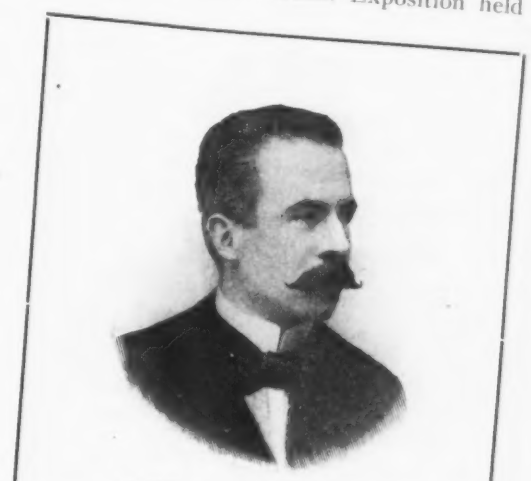
At a council meeting of the commission, held later in the day, the council declared its readiness to undertake the task of organizing future international electrotechnical congresses. The council also accepted the invitation transmitted through the American committee in regard to holding a congress at San Francisco in 1915. This invitation emanated from the board of directors of the American Institute of Electrical Engineers.

The success of the official work of the commission was largely due to the ability of its executive staff, headed by the general secretary, Mr. C. le Maistre.

The meeting of the committee was held in the handsome assembly-hall at the Prefettura in Turin, which was placed at the disposition of the commission by the Provincial Council. The success of the arrangements for the meetings was largely due to the able and cordial services of the Italian national committee, its president, Signor Luigi Lombardi, professor at the University of Naples, and its secretary, Signor Guido Semenza, of Milan.

International Electrical Congress of Turin.

Among the pleasant features of the International Congress of Turin not noted in our issue of last week were the presentation to Prof. Antonio Pacinotti of a memorial album and a formal visit to the monument of the late Prof. Galileo Ferraris in Piazza Castello. The album was offered by the Italian Electrotechnical Association, which invited members of the congress to be present on the occasion. The presentation was made by President Lombardi, and other addresses were made by Professor Mengarine, of Rome, and Prof. S. P. Thompson, of London. Upon the visit to the statue of Professor Ferraris three crowns were placed on the pedestal; one, of bronze, offered by the French members of the congress; another, also of bronze, by the American members of the congress, and a third, of laurel, by the city of Frankfort-on-Main. M. Ferdinand Meyer, in the name of French electricians, and Mr. Philip Torchio, in the name of American electricians, made short addresses; Mr. Hartmann, of Frankfort, offered the wreath from the city of Frankfort as a recognition of the leading part which Professor Ferraris had taken in the work of the International Exposition held in that



PROF. LUIGI LOMBARDI,
President Turin International Electrical Congress.

city in 1898. The Mayor of Turin, in the name of the city, thanked those taking part in the tribute to the memory of the great savant who had honored Italy.

At the reception given to the congress by the municipality on Tuesday, Sept. 12, President Lombardi, Mr. C. O. Mailloux and several others delivered addresses in response to the address of welcome by the Mayor. At the banquet on Wednesday, Sept. 13, at which ladies were present, President Lombardi and officials of the city and province greeted the guests, and thanks for the reception were tendered by representatives of the various countries taking part in the congress. The total of registrations at the congress up to its close was about 450.

At the general session of the congress on Sept. 13 but one subject was discussed, namely, the manner of providing for future congresses. Prof. Clarence Feldman, of Holland, made a motion on the subject which was seconded by Prof. S. P. Thompson, for Great Britain, Mr. C. O. Mailloux, for the United States, and by members representing other countries. The motion, which was carried unanimously, requested the International Electrotechnical Commission to accept the task of the organization of future electrotechnical congresses, both as to dates and places where they were to be held, the charge of details of each congress being confided to the international electrotechnical committee of the country in which the congress will be held,

which committee will invite the assistance of the electrical societies in that country.

At the final general session, held on Saturday, Sept. 16, a number of important resolutions were adopted, which resolutions had been submitted for action at the general session by various sections of the congress.

METRIC SYSTEM.

A resolution proposed by Section 3 of the congress and unanimously approved was as follows: The International Congress of Electrical Application of Turin congratulates the American Institute of Electrical Engineers on its practice of giving in its publications, within parentheses, the equivalent in the metric system of values expressed in English measures. Since this practice facilitates greatly the reading of electrical literature in all countries employing the metric system and at the same time constitutes an excellent precedent toward a complete unification of international weights and measures, the congress recommends that all countries not having adopted officially the metric system shall follow the example of the American Institute of Electrical Engineers.

ILLUMINATING ENGINEERING.

Proposed by Section 4 and unanimously approved: The congress believes it to be desirable that an international committee be named for the study of various systems of lighting and of technical questions relating to lighting; and having been informed that the Illuminating Engineering Society of London intends to constitute such a committee, which will maintain relations with all existing national and international photometric bodies, the congress approves this initiative.

TRAIN ACCELERATION.

Proposed by Section 5 and unanimously approved: The committee of the fifth section of the congress, to which was referred a proposition by Mr. C. O. Mailloux concerning the definition and the practical measurement of acceleration of trains, reported the following conclusions: In view of the fact that in practical traction work the speed of trains is always expressed in kilometers per hour (or in miles or in versts per hour) and that this usage is absolutely universal; that it is logical, following this definition of speed of trains, to express acceleration per second; that this definition of acceleration of trains is solely employed in America and is also used in other countries; that this proposition was received favorably at the Marseilles International Congress of 1908; therefore, the congress recommends that the acceleration of trains be expressed in kilometers per hour per second (or in miles or versts per hour per second).

LEGAL UNITS AND ELECTRICAL REGULATION.

Proposed by Section 8 and approved unanimously: In view of the fact that electrical legislation is being enacted in various countries and that each country will establish statutory units and regulations governing public works and other electrical installations, it is recommended: 1. That in any legislation scientific matters shall be sharply separated from matters relating to regulation. 2. That scientific matters shall be revised and fixed by a permanent electrical commission in each country. 3. That in each country there be established regulations which, without affecting local rights, will permit the easy and prompt execution of installations.

TAX ON ELECTRICAL APPLICATIONS.

Proposed by Section 8 and unanimously approved: In view of the fact that the extension of the applications of electricity has been of great economic benefit to the world; that it is to the interest of every country to encourage the development of the industries engaged in the production, distribution and application of electrical energy; therefore, fiscal action of governments in relation to the electrical industry should be within reasonable limits, in order not to trammel its development; that of all the applications of electricity electric lighting is the only one upon which a fiscal burden can be placed, provided that this bears a proper relation to other systems of lighting and is not subject to arbitrary action upon the part of local governing bodies; that, finally, any tax on electric heating would absolutely prohibit its industrial application has been demonstrated in countries where such a tax exists; therefore, it is recommended:

1. That countries shall not place a tax on the production or sale of electrical energy, with the single exception of private electric lighting. 2. Such a tax should be so fixed and applied as not to put electric lighting at a disadvantage with respect to other methods of lighting. 3. That additional municipal taxes should not be left to the discretion of municipalities, but regulated by the state and kept within limits fixed in advance. 4. That financial statistics should be compiled to accord with statistics of operation and should include all the information necessary to make them useful for reference.

ELECTRICAL EDUCATION.

A number of members of the congress, including Mr. C. O. Mailloux, submitted a resolution asking that the uext international electrical congress shall include a section on education. The resolution was accepted by the congress as a recommendation and the president was requested to refer it to the committee on organization of the next congress.

Abstracts of the various papers presented before the congress, and of their discussion, will appear in the issue of next week and in following issues.

Wireless Telegraph Patent Decision.

Judge Hale, of the United States Circuit Court for the District of Maine, handed down at Portland, Me., Sept. 21, a decision sustaining the fundamental claims in a patent (No. 706,736) issued to Prof. R. A. Fessenden on Aug. 12, 1902, on an application filed Dec. 15, 1899. The patent has thirty-five claims, of which sixteen were sustained and the bill dismissed as to the other nineteen claims, some of which were not in issue.

One of the objects of the Fessenden invention, as stated in the patent, was to replace the coherer by a receiver which is constantly receptive. The coherer is normally non-conductive and does not respond to other than maximum activity on the wireless circuit, and after being rendered conductive must be restored to its normal or non-conductive condition. The inventor proposed to substitute for this system one in which the wave-responsive device is self-restoring and always capable of being affected by the waves, and not, as in the case of the coherer, incapable of response to waves for a portion of the time.

Two of the claims of the patent are on a transmitter system, including a closed tuned circuit adjusted to radiate trains of electromagnetic waves in which a single frequency is predominant, together with a receiver system, including, first, a closed circuit, tuned to said predominant frequency, and second, a current-actuated, wave-responsive device. Another claim is for a system of wireless transmission by electromotive waves; apparatus for utilizing the energy of said waves, including in combination a conductor constructed and arranged to cause the energy of each wave to develop electric current flow; means for rendering the current flow persistent and for co-ordinating the currents developed by successive waves to cause them to act cumulatively upon each other to produce an increased or reinforced resultant-current flow; a means operated by said resultant-current flow to produce a sensible effect or indication.

The opinion states that at the time of the application for the present patent in 1899 there were only four United States patents on wireless telegraphy, three of which had

been issued to Marconi and the other to Lodge. One of the experts in the suit is quoted to the effect that the present invention is the first disclosure of wireless telegraphy in which the sending and receiving apparatus is adjusted to its mutual maximum effect, not merely with the adjustment of mast-wire to mast-wire, as in the prior art, but with the reinforcement due to the additional effect of a tuned local circuit, including the spark-gap at the sending station, and a tuned local circuit, including the detector, at the receiving station; and that this is the first disclosure in the art of wireless telegraphy of the above conditions in conjunction with a current-operated wave detector, it being added that the presence of the coherer is inconsistent with the complete tuning which is obtained under a current-operated, wave-responsive device. Imperfect electrical contact, the court says, was at the basis of electric-space telegraphy, and until Fessenden made his invention there had never been a wireless-telegraph system except such as employed the voltage-operated coherer. In such a system no tuning whatever could be had beyond getting the two antennas into resonance with each other, and in order to do this the coherer must be taken out of the circuit on which the current had to travel.

As to the defense that the patent does not disclose invention, the court states that the idea of Fessenden was to discard the method of operation by the imperfect contact and to use a current-operated, wave-responsive device operated through a good circuit contact, its purpose being not to use the big waves to "knock down" the detector, but to have an open door through which every wave could flow, and by which he could have a constantly receptive receiver affected by all the waves all the time. Marconi, he said, created a system of definite signals without wires, and while the invention of Fessenden is not entitled to be pronounced as important an invention as that of Marconi, the court considered it to be a pioneer invention which gave a new direction to the progress of the art. The imperfect electrical contact was at the basis of space telegraphy until Fessenden made his invention. No tuning could be obtained with the use of the coherer except to get the two antennas into resonance with each other. What was wanted with the coherer was to have all the energy of the train of waves bunched into one wave, so as to knock down the obstruction of the detector—to weld it into good contact and let the current through it. Marconi's idea was to tune for the purpose of getting a big wave, while that of Fessenden was to make a current out of all the waves. With the latter system the current-operated, wave-responsive device is always in a circuit that is to be tuned, while with the presence of the coherer all the tuning that could be done was from mast to mast. The court concluded that complete tuning, therefore, was possible only in such a system as that of Fessenden, and that the tuning of the prior art was essentially and typically different from the tuning involved in Fessenden's invention.

As to anticipation, the defendant cited the prior patents of Marconi and Lodge, and also an article by Messrs. Northrup, Pierce and Reichmann, which appeared in the *Electrical World* of Dec. 18, 1897. The court states that after careful study of the record it is persuaded that the defendant has not shown that the patent is void by reason of anticipation. As to infringement, the court held that as the receiver of the defendant is susceptible to the action of every current, large or small, and is not dependent for action upon high voltages, it is current-operated and not voltage-operated; that it responds to action of all the waves of the train instead of only to some of them, and enables the effect of all the waves to be added together. The testimony of an expert is quoted as establishing that the so-called crystal detectors are current-operated detectors, and therefore belong to the same class as that disclosed in the patent in the suit, since they do not change their electric conducting properties from wave to wave, but behave to one wave in a group as impartially as they behave to another, having good contacts instead of poor, shaky or powder contacts. The court also held that the tuning of the defendants is not merely the crude tuning of Marconi and other predecessors, but is substantially the tuning of the Fessenden patent. In conclusion the court held that it cannot be said that the invention of Fessenden presents a solution of all the great problems in electric telegraphy without wires, but it can be claimed that it opens a little wider the door of invention in the art of wireless telegraphy. The decision will be appealed to the United States District Court.

Los Angeles Municipal Hydroelectric Plant.

In accordance with instructions from the Public Service Commission of Los Angeles, Cal., Mr. E. F. Scattergood, chief engineer of the city power bureau, has presented to the commissioners a report of recommendations for the commercial distribution of electric energy to be generated by the proposed municipal power plants along the route of the aqueduct.

According to estimates made in May, 1910, the cost of a complete distributing system for supplying all street lights and all commercial light and power within the city limits, an area of approximately 100 sq. miles, excluding railways, was $4,250,000. This included all underground conduits and overhead poles, with cables and wires sufficient for an excess of 50 per cent greater business than that realized in such year. It also allowed for all connections, transformers and meters, together with the necessary substations and shops. According to a similar estimate just now completed, the cost of such additions as would be essential to provide for the probable business of the year 1913 gives a total of $5,500,000.

An estimate has also been made of the total yearly cost of operating and maintaining the necessary hydroelectric system and distributing system to care for the business mentioned, assumption being made that the city enjoyed all such business. An allowance of $50 an arc lamp for street lighting was made, as against the present rate of $75.60 a lamp per annum, and a base rate of 6 cents assumed for commercial light and power. The results of these calculations show that with this total consumption a net profit to the city of $700,000 per annum would be derived after deducting from the earnings all operating and repair expenses, interest on the entire investment, depreciation of the total property and a sinking fund allowance for canceling the bonds. During the year 1913 the business will probably be 60 per cent greater than in 1910.

With reference to the matter of auxiliary steam plants the report states that the expense connected with providing for and maintaining these must necessarily be met by corresponding increase in rates to consumers and should be incurred only so far as the added reliability of service would justify such rate advancement, viewed from the consumer's standpoint. The preliminary report of the consulting board of engineers for the power project states that an auxiliary plant is not deemed necessary, as the probability of serious interruptions of service would be too remote.

The proposed hydroelectric power plant, including penstocks, power houses and transmission lines, would be more reliable than a steam plant properly located to furnish service to the city. The installation as planned will not require more than 200 sec.-ft. average flow, and the capacity of the Fairmont reservoir would be sufficient to operate the plant for a period of eighteen days, allowing time for any necessary repairs above such point.

The street-lighting contract for the coming year must necessarily be determined independently of the question of providing for a complete municipal distributing system, because of the time requirements. Assuming that the companies furnishing the lights were not required to make ex-

tensions to the existing system, $60 per arc lamp per year, the report states, would conform to the present rates for commercial light and power. The present number of arc lights is 3200, with a contemplated addition of 360 during the coming year; the total cost to the companies providing such additional lights should not exceed an average of $150 per lamp, including the cost of pole-line extension and complete erection. The difference between the present contract price of $75.60 per arc lamp per year and $60, as above, applied to the total of 3560 lamps would more than defray the entire expense of installation. The report adds that the installing at the city's expense of such additional lamps as will be necessary, the same to be the property of the city, with a reasonable rate for street lighting for the entire system, would be the most economical.

In connection with this report the Public Service Commission has instructed its attorney, Mr. V. B. Mathews, to draft a resolution requesting the City Council to call a special election at once for the purpose of voting on a bond issue of $5,500,000, the figures mentioned by Mr. Scattergood for a municipally owned distributing system. This is to be ready for service on or before Jan. 1, 1913.

The commission announces its intention of disregarding any suggestions for a leasing of the systems of any of the private companies or for the selling of power in blocks to these for distribution, favoring a municipal service to consumers direct.

Public Utilities from the Civic Standpoint.

On Monday afternoon, Sept. 25, the International Municipal Congress, which has been holding a two-week convention and exposition in the Coliseum, Chicago, Sept. 18 to 30, gave over its session to the discussion of public utilities, with Mr. Bion J. Arnold, of Chicago, acting as chairman.

Mr. Arnold opened the meeting with a brief review of the conditions leading up to the establishment of public-utility commissions, which are now found in many states. The last thirty years, he said, was a period of rapid advance, during which inventors and engineers were producing many new ideas which the capitalists were busy financing and promoting. As a result franchises were granted easily and on liberal terms, often being awarded to competing undertakings. Later, these competing corporations, compelled to combine and absorb by economic conditions, produced monopolies, the privileges of which, as well as the financial management, were sometimes abused. Allowances were not made for depreciation, and in some cases even maintenance was not provided for, so that as the original franchises lapsed the corporations found themselves without the means of rehabilitating their badly run-down plants, and so heavily capitalized as to preclude their raising further funds. About this point the commissions were developed, and the problems of regulating have since been undergoing solution in many cities and states. In conclusion Mr. Arnold declared he believes that where a company has been judiciously managed the differences between property value and invested capital, represented by promoter's profit, fees, etc., should also be allowed to earn a fair rate of return for the investors, all over such a fair rate being turned back into an amortization fund to retire the burden of these early costs, so that finally the physical value shall equal the capitalized value of the plant.

In discussing "Public Lighting" Mr. E. L. Elliott, editor of the *Illuminating Engineer*, next referred to the close interrelation between the development of municipal methods and public lighting. Modern street illumination, he said, is not alone a matter of putting up as many lamp-posts as there are funds for in the city treasury, but the character of the illuminants and their location should be carefully considered. After mentioning the shortcomings of the early open and inclosed-carbon arcs the speaker enumerated the yellow-flaming arc, the white-flaming arc, the magnetite arc and the tungsten incandescent lamp as the present practical street-lighting units. The custom of using magnetite arcs with clear globes he declared to be highly objectionable and a return to the primitive conditions of glare surrounding the old open arcs. The reason for this clear glass, Mr. Elliott explained, is one of economy, for white-opal glassware cuts down the light greatly from the bluish-magnetite arc, although having small effect on that from the ruddy-flaming arcs and tungstens.

While post-tungsten lighting is more expensive than the crude and simple arc fixtures, the handsomer effect secured by both night and day is greatly to be desired. Even the coarsest elements of humanity have an instinctive regard for beauty, said the speaker. As an incident illustrating this fact he cited the great reduction in mischievous breakage of glassware when the former ugly square gas lamps in New York were replaced by the present circular globes. Mr. Elliott also showed how the type of fixtures should be made appropriate to the proportions of the street they light, and spoke of the efforts to project more of the flux from street lamps in the useful directions along the roadway by means of prismatic glassware and reflectors. The speaker also made a strong plea for better and ample park lighting, arguing that as the evening is the only time of leisure for the masses the parks should be either thoroughly lighted or closed to remove opportunities for viciousness and immorality.

A paper by Mr. H. M. Byllesby, Chicago, was next read in Mr. Byllesby's absence by Mr. Arnold. After reviewing the events of the last quarter-century, the accomplishments of engineers and inventors and the undertakings of promoters and capitalists in carrying out these developments, Mr. Byllesby called attention to the decrease in price which the commodities made and sold by public-utility corporations have undergone in late years. In many cases, he said, the companies have even extended their services into unproductive fields at a loss.

The public and the corporations are fast approaching a common meeting ground, wrote Mr. Byllesby, and the day of fair dealing between corporations and the public and corporations and the government is at hand. In the public-utility commissions the demand of the companies is only for able, experienced men, familiar with utility management and themselves men of some accomplishment. The public will then better realize that the utility corporations should be encouraged rather than strangled, and their beneficent monopoly will be protected.

Mr. Arnold then called upon Mr. W. D. Norton, formerly assistant secretary for the New York Public Service Commission of the First District. Refuting the claim that commission regulation is expensive, Mr. Norton explained that the body under which he served and which has jurisdiction within the limits of New York City has besides its other numerous duties succeeded to the functions of the former rapid-transit commission, an organization with an $800,000 yearly budget and employing an engineering staff of 500. The present budget of the Public Service Commission, little more than a million dollars, is even less than the expected rate of growth of that of the old transit commission alone. Mr. Norton also spoke of the advantages of uniform accounts and reports.

In answer to questions from the audience Mr. Arnold brought out the point that while a street railway cannot have "going value," like a gas or electric-light plant which has expended funds to develop its business, the railway company should be given an opportunity to retrieve its early losses, as he before outlined.

Mr. W. H. Buist, of Dundee, Scotland, said that in Great Britain it is a notable fact that the municipal plants are the best managed, most stable and furnish the best service. The Edinburgh railways, he said, under private management with municipal division of profits have given much

trouble, while the municipally owned Glasgow roads are in a flourishing condition and last year paid $500,000 net profit. Municipally owned utilities in Great Britain, said Mr. Buist, are by their charters required to pay off their capital debts in a limited time.

Mr. Arnold said that thus far in America it is believed better results can be obtained with private management under regulation. The talent required for efficient management, he said, requires something more than merely the usual rate of interest or salary returns.

Library of the United Gas Improvement Company.

An address on the subject "Technical Literature Abstracts and Information Bureau Work in the Library of the United Gas Improvement Company" was made at the annual meeting of the Special Libraries Association, Engineering Societies Building, New York, on Sept. 27 by Mr. F. N. Morton. The address explains the origin and broad scope of the extensive library of the United Gas Improvement Company.

Mr. Morton, the librarian, is a graduate of a technical college, and has spent seventeen years serving in all departments of the gas and electric business, both technical and commercial. It was intended at first that the principal work would consist of keeping the various officials and heads of departments informed of the current progress and development in subjects in which the company is interested. This is done by a system of abstracts. The work has broadened, however. The forty periodicals taken by the company are read, and abstracts are made of all articles of interest. The abstracts are arranged and classified for filing. They are issued at intervals of about ten days. Many requests for general information are received, and in such cases special reports are prepared. For the responses to many important questions asked of the librarian a technical knowledge is essential.

Chicago Convention of Illuminating Engineering Society.

About 135 members and visitors, including several ladies, attended the opening session of the fifth annual convention of the Illuminating Engineering Society in the Congress Hotel, Chicago, on Monday morning, Sept. 25. Mr. V. R. Lansingh, of New York, vice-president, presided and introduced Mr. John F. Gilchrist, of Chicago, chairman of the convention committee, who welcomed the visitors. The response was made by Mr. Joseph D. Israel, chairman of the Philadelphia Section.

PRESIDENTIAL ADDRESS.

In the absence of Dr. A. E. Kennelly, of Harvard University, president of the society, who was in Europe as American delegate to the meetings in Turin of the International Electrotechnical Commission and the International Electrical Congress, his presidential address was read by Vice-president Lansingh. Dr. Kennelly chose as his subject "The Relations of Physico-Physiological Research to Illuminating Engineering," and in a brief paper he considered the closeness of the connection between apprehension and accomplishment in the measurement of light. The writer showed that every science is developed from the complex and manifold to the simple and unique. The number and degree of precision of the measurements in a branch of science gage the extent to which that branch has become exact. In illuminating engineering it would be useful to possess a knowledge of certain physico-physiological constants for the human eye. "We ought to know," says the president of the society, "the lumens per area-watt produced in the normal eye for each color and its frequency, as well as for all working intensities." In short, the address was a plea for "the accumulation of observations on the photometric properties of our eyes by all who may have the opportunity to make them."

Dr. E. P. Hyde, of Cleveland, moved that the address be referred to a committee and that at the same time the society express its regret at the absence of its honored president. Messrs. J. R. Cravath, of Chicago; E. P. Hyde, of Cleveland, and W. H. Gartley, of Philadelphia, were appointed as this committee.

NOMENCLATURE AND STANDARDS.

In the absence of Dr. Alex C. Humphreys, of Hoboken, N. J., the report of the committee on "Nomenclature and Standards" was read by Mr. Joseph Langan, of New York, assistant secretary of the society. The report consisted of a progress report from the subcommittee on photometric units, signed by the chairman, Dr. Clayton H. Sharp, of New York. The sub-committee reported some progress and concluded with two recommendations. One was that the term "lighting" be used to designate the product of luminous flux by the time, the symbol therefore being L. The L then would displace the Q used as a symbol for this quantity in the 1910 report.

The other recommendation relates to symbols to represent candle-power and flux. These cannot be represented here for the reason that their reproduction would involve the making of engravings for that purpose. It may here be remarked that this consideration will also render it difficult to secure the adoption of the symbols, which would involve the casting of special types or the addition of special matrices to the magazine of linotype machines. Even should special type or matrices be available, few printing offices would carry them in stock, and in cases where this was done the characters would, owing to infrequent use, be apt to become mislaid. These conditions applied to the special characters (French script) adopted to represent magnetic quantities at the Chicago International Electrical Congress of 1893. An American type founder was induced to make matrices from which to cast these special characters and a number of printing offices were induced to purchase the corresponding type. The experience was, however, that in time the special type could not be found when needed and finally the type founder ceased to make it owing to the small sale.

The recommendation is that the symbol for mean spherical candle-power shall be $I\Theta$, with the horizontal bar of the Greek letter projecting on each side; for mean upper hemispherical candle-power the letter I followed by a symbol representing the upper half of the special character; for the mean lower hemispherical candle-power the letter I followed by the lower half of the character; for total flux, $F\Theta$; for the upper or lower hemispherical flux the letter F followed by the upper or lower half of the special character. The report states that these symbols were proposed by Professor Blondel and differ but slightly from those used in Germany, the difference being that the bar is carried a little beyond the circle on each side. The committee further recommends that negotiations with individuals and societies in other countries be carried on with a view to an international conference on the adoption of the symbols proposed.

Dr. A. S. McAllister, of New York, presented a written discussion on this report which was read by Mr. P. S. Millar, of New York, general secretary. Dr. McAllister pointed out that confusion would very likely arise by the use of the same letters of the English alphabet for symbols for both electrical and photometric units, citing the well-known E, I and R of Ohm's law as already widely in use. The writer recommended the use of the Greek letters φ (psi) for light flux and β (beta, lower case) for light flux density, on account of their similarity to the symbols for magnetic flux. It was also pointed out as a practical objec-

tion that the symbols recommended by the sub-committee could not be set in type in the ordinary printing office.

REPORT ON PROGRESS.

The report of the committee on progress, submitted by Dr. Louis Bell, of Boston, chairman, was read by Dr. P. W. Cobb, of Cleveland, in the absence of the author. The committee reviewed the progress of the year in relation to luminous and flaming-arc lamps, small intensive-arc lamps, the quartz-mercury arc and the Moore tube filled with neon. In electric incandescent lamps some reference was made to the wire-drawn tungsten. The improvement in mantles for gas lamps was commented upon and there was some reference to high-pressure gas lighting and to the pressure-wave system for the lighting of gas street lamps. In methods of illumination the most notable tendency has been toward the use of indirect and more especially semi-indirect lighting. Reflectors have been undergoing steady improvement. During the year the American Association for the Conservation of Vision was founded, and the report concluded with the recommendation that the society co-operate with foreign commissions to report on methods of illumination in their practical bearing on vision and on industrial processes.

Mr. George S. Barrows, of Philadelphia, a member of the committee, elucidated some references in the report to high-pressure gas lighting and to the pressure-wave system of lighting gas street lamps. Mr. J. G. Henninger, of Cleveland, spoke of the great improvement in metallic reflectors and said that reflectors are now available that are four or five times as good as those on the market a year ago. It is quite practicable to get 65 per cent of the total flux in the lower hemisphere and in some few cases a figure as high as 90 per cent has been reached. Mr. Rose, of Schenectady, spoke of the inclosing of the arc of flaming-arc lamps as a method of increasing the life of the lamp. This method increases the life of a lamp to a considerably greater extent than the figure mentioned in the committee's report. Mr. E. L. Elliott, of New York, said that it was not advisable to use simply clear glass globes with a magnetite arc. He advocates inner globes. The light should be diffused even at the loss of efficiency. The speaker deprecated glare in illumination.

Mr. L. B. Marks, of New York, pointed out the advancement that had been made during the year in systems of lighting. Particular progress has been made in the use of systems of general illumination, supplemented by local illumination where necessary. Under the old plan in factories and industrial establishments it has been the practice to use a drop lamp with an opaque reflector over the special object to be illuminated. The tendency of to-day is to get away from that strictly localized system of illumination and modern factories are illuminated in an entirely different way, placing greater stress on general illumination even at greater cost. Mr. J. R. Cravath, of Chicago, also pointed out the importance of more general lighting and less localized lighting. Not only the quantity but also the quality of light should be considered. Mr. Cravath also expressed some surprise at the high figures of efficiency of reflectors reported by Mr. Henninger. Mr. W. M. Skiff, of Cleveland, spoke of the use of low-voltage miniature lamps on machines in factories to direct light at the exact point where especially good illumination is desired over a small area.

PAPERS RELATING TO GLASSWARE.

Monday afternoon's session was devoted to the reading of papers on glassware. Three of these were contained in a "Symposium on Illuminating Glassware." The introduction to this symposium was prepared by Mr. Bassett Jones, Jr., of the papers committee, and was read in his absence by Prof. W. E. Barrows, Jr., of Chicago. The three papers following were written by representatives of manufacturers of glassware for illumination. The first, by Mr. George H. McCormack, of New York, was read in the absence of the author by Mr. Godinez. Mr. McCormack said in his paper that the evidence of monotony in design is one of the most difficult problems to be solved by the manufacturer of shades. Intrinsic brilliancy demands serious consideration also. The modern reflector must be of a type which may be scrutinized from below with perfect eye comfort. Depolished inner surfaces give excellent results and produce no glare. With reference to opal glass (opalux) the transmission of light through it is accompanied by perfect diffusion from the minute particles of opal suspended within the glass, and it is this effect which lends the sparkle, color and life characteristic of opal in reflector or inclosing-bowl form.

Mr. A. J. Marshall, of New York, the author of the second paper in the symposium, described the Holophane system of illumination as it now stands. In this system are included (1) prismatic semi-inclosing and totally inclosed globes and (2) prismatic reflectors. These two classes are combined in one-piece and two-piece units and also with other glassware, as satin-finish, opal and tinted glassware. The principles governing the designing of prismatic-glass globes were traversed, as well as the construction of prismatic reflectors. Various combinations and fixtures were described and illustrated.

The third paper of the symposium, written by Mr. L. W. Young, of New York, related to Alba glassware and was read by Mr. S. G. Hibben, of Pittsburgh. The glass described is of a clear or crystal base, holding in itself by a species of colloidal suspension a very great number of infinitesimal flakes. These flakes act to give color to the glass, to break up the rays of light and to aid in the reflection of light. Lantern slides were given to show the characteristics of Alba shades, globes and special shapes. As to the efficiency of transmission of this glass compared with other glasses, these figures were given: Standard crystal roughed inside globe, when new and clean, 16.75 per cent; thin opalescent, 15 per cent; regular Alba, 13.5 per cent. Artistic effects in this glass are now being obtained in a large and increasing number of special shapes.

The paper by Mr. E. H. Bostock, of New York, on "The Manufacture of Glass for Illuminating Purposes" was abstracted by Secretary Millar. Glasses are described by this author as structureless solids. Manufacturing processes and methods of coloring were described, and reflecting glassware is taken up in the second part of the paper. Prisms of glass may be arranged with reference to strength of light flux to make almost a perfect distribution. The author says, however, that for diffusive lighting, the newest and the best development is that of the already well-known phosphate glasses. One great objection to the use of prism glass has been that its sharp-drawn straight lines do not conform to any decorative scheme. Recently, however, a wave-line prism glass has been placed on the market. This glass, at any section, shows the true definite-angled prism, but its wavy line fits it for use in decorative schemes.

"Modern Requirements of Reflector Design" was the title of a paper read by Mr. F. L. Godinez, of Jersey City, N. J. The author goes into the technical requirements of reflector design and pays considerable attention to the ultra-microscope as affording a means of rendering visible the most minute particles within the structure of glass. Mr. Godinez thinks that glassware embodying a proper relation between transmission phenomena and selective absorption will "assist in supplying a long-felt want, attainable with modern illumination at a consumption of 1.5 watts per candle, instead of 4 watts for the same quantity of light." As a result of considerable research, the author has developed a new glass that is manufactured in a delicate amber tint and also in a most subtle tone of old rose. The author suggested that when a value in foot-candles is given as typical of any special condition attention should be directed to the fact that a factor of depreciation might

prove a sensible adjunct, since the calculated values represent initial performance of lamps and reflectors. In concluding his paper, he expresses the hope that there may be instituted an impartial standardization test with which the merchant, for instance, might demand compliance by any manufacturer when perplexed by differing contentions of salesmen in relation to proper illuminating units and methods.

The papers relating to glassware were discussed at some length at Tuesday morning's session when Dr. H. E. Ives, of Cleveland, vice-president, was in the chair. Mr. V. R. Lansingh, who spoke first, made a number of comments on points brought up in all five of the papers. He explained how pressed glassware was made in such a way as to have as high a polish as by the off-hand process. He discussed the reflecting properties of opal glass and explained that with the milk opals the glass must have considerable density. Another point made by the speaker was that uniformity of illumination is desirable from the engineering point of view; what is to be avoided is monotony of installation. On the question of specular reflection it was declared that it made no difference on the plane to be illuminated whether light came from specular reflection or diffuse reflection. As to the prismatic system, perhaps its worst enemy is itself. Acting by specular reflection it must be used correctly. As to the absorption of Alba glass, Mr. Lansingh pointed out that the percentage is much greater for pressed globes than for blown globes. Glare and specular reflection are synonymous only when one looks directly into the reflector, and this is not done often. Commercial glassware can be used in ordinary residences in more or less modified forms. The speaker also said that the conditions under which photometric curves are made should always be stated and studied to make the curves really valuable.

Mr. W. J. Cady, of Newark, Ohio, differed with some of the conclusions expressed by Mr. Godinez. One point he made was that the intrinsic brilliancy of any reflector cannot be as great as that of the lamp itself.

Mr. J. R. Cravath, of Chicago, mentioned the need for a glass to be perfectly smooth, and so easily cleaned, having about the diffusing qualities of ground glass without the latter's roughness. Such a glass is needed for skylights and other purposes and if available in flat plates would be a valuable material.

Dr. P. W. Cobb, of Cleveland, discussed several points brought out in the papers—among others that of intrinsic brilliancy. The manufacturers of glassware are tending to bring out glassware with depolished surfaces or with diffusing mediums, and this tendency is a good one. In its physiological aspects, at least, the question of color is still to be settled. Dr. Cobb pointed out that shadows have much to do with the cheerful "mellow glow" of sunlight and the oil lamp in the home. Light can be produced by the use of artificial light sources and proper shades that will approximate daylight very closely.

Mr. Norman Macbeth, of New York, congratulated the society on the entrance of commercial discussions into its proceedings. He also, by various concrete illustrations, showed how essential it is to explain the conditions under which photometric curves are made.

Mr. G. H. Stickney, of Harrison, N. J., spoke briefly on the effect of specular reflection on polished surfaces.

Mr. A. J. Marshall, of New York, and Mr. S. G. Hibben, of Pittsburgh, had a brief colloquy referring indirectly to the merits of Holophane and Alba glassware. In answer to Mr. Marshall's questions, Mr. Hibben said that sometimes the flakes in Alba glass are visible but more often not; they are supposed to be invisible in the higher grades of the glass. Alba glass has some fluorescence; the speaker did not know just how much. A number of Alba one-piece blown-glass balls are in use in the Chicago & Northwestern passenger terminal in Chicago. Mr. Marshall said that he thought the larger flakes were imperfections or bubbles. He said that the claims made for Alba glass are to some extent contradictory. The glass is not in the true sense of the word reflecting; it is rather a transmitting medium. The speaker did not think it gives true color transmission. It does fairly well for several purposes, but answers no one purpose perfectly.

Mr. Godinez summed up for Mr. McCormack and himself. He discussed briefly the question of monotony of lighting installations and explained his ideas of store lighting. He thought departure from uniformity desirable for advertising purposes. In relation to the question of looking into a reflector he said that it is practically impossible to prevent the eye from straying to the source of light if the latter is not concealed. Mr. Godinez remarked that it is interesting to learn what the operating companies are doing in supplying their customers with illuminating engineering advice. In many cities the central-station companies send out with the bills the statement that illuminating engineering installations designed by the local company will be guaranteed or made satisfactory, while no responsibility is assumed for installations made by others. Where changes in lighting are desired attractive sketches are furnished. In this way the public is taught increased respect for illuminating engineering.

Mr. Marshall, in his closing, said that the glassware described in his paper has been improved as a general thing since its introduction, although changes in design may have increased the percentage of absorption in some cases. Some considerations of physical efficiency have been sacrificed in some plainly stated cases for decorative effects.

Mr. Hibben in his closing remarks said that the curves in Mr. Young's paper were made by the Electrical Testing Laboratories of New York and could be accepted as disinterested and authentic. The ribs shown on some of the samples of Alba glass illustrated are used entirely for decoration and the glass is not to be considered a copy of any former type.

PAPERS RELATING TO GAS.

Mr. George S. Barrows, of Philadelphia, gave a talk illustrated by a number of lantern-slide pictures on "Natural Gas; Its Production and Utilization." Among other things he said that natural gas is nearly pure methane and that the average pound-Fahrenheit thermal units per cubic foot in natural gas are about 1000, compared with a corresponding figure of about 600 for manufactured gas.

Mr. F. H. Gilpin, of Philadelphia, abstracted his paper on "Recent Small Gas-Lighting Units." The use of small units is comparatively new in the gas-lighting field, but during the last two years several small gas-lighting units have been tested in various ways. The speaker gave the results of some of these tests and showed that on the whole the efficiency of the new small units was about 25 per cent to 30 per cent higher than the older and larger units. The tendency of the smaller units seems to be to give considerably higher efficiency. Mr. Gilpin also remarked that all gas lamps collect dirt internally. If this is removed and a new mantle supplied, the lamp will be restored practically to its original efficiency. It will not be sufficient to renew the mantle alone.

Mr. T. J. Little, of Philadelphia, questioned whether in general smaller gas-lighting units are more efficient than large ones, provided the mantles are of exactly the same structure. However, there is a great possibility of increasing the efficiency of larger burners. The speaker thinks the stack lamp is the coming gas lamp.

INCANDESCENT ELECTRIC LAMPS.

An interesting paper entitled "Recent Developments in the Manufacture of Incandescent Electric Lamps" was read by Mr. J. E. Randall, of Cleveland. Speaking of carbon lamps, the speaker showed that the best lamps of ten years ago were as good as the best of the present year.

That the average has risen is due to the elimination of defectives. The Gem lamp shows a sufficient superiority in quality over the regular carbon-filament lamp to justify its more extensive use. The greater part of the paper, however, was devoted to metal-filament lamps. The mechanical weakening of the tantalum wire, due to offsetting when kept on alternating current, has prevented the general introduction of the tantalum lamp in this country. It was, however, the first production of a real drawn-wire lamp. But the tantalum lamp cannot continue to compete with the drawn-wire tungsten lamp in its present form. In relation to the pressed-filament type of tungsten lamp the author believes that the loose contact at the bend of the filament with a support that is rigid makes the hardiest lamp of that type. The drawn tungsten wire has served to make the tungsten-filament lamp a universal lamp. The wire may be considered to consist of pure tungsten. There is no offsetting either on direct current or alternating current and tests indicate that the wire is less brittle at every stage in the life of a lamp than is the pressed filament. Nevertheless, the lamp should be handled with reasonable care in order to prevent breakage. Mr. Randall made an interesting comparison, near the end of his paper, which may be quoted in his own words:

"Having traced recent developments up to the latest, it may not be amiss to consider the future. If the progress in lamp development may be gaged by the highest filament temperature at which each new lamp will show a given performance, one has a rational measure. For example, if 90 per cent of the theoretical candle-power hours are developed in 1000 hours' burning, candle maintenance and mortality both considered, the advance from the raw carbon-filament lamp to the tungsten-filament lamp will show something as follows:

Raw carbon filament lamp (cellulose carbon)	100
Treated carbon filament lamp	119
Metallized carbon filament lamp	149
Tantalum filament lamp	206
Osmium filament lamp	370
Tungsten filament lamp	359

"This comparison excludes many items, such as process difficulties, lack of wattage range, lack of voltage range, lack of suitability for both alternating current and direct current, cost, etc., which affect commercial values. It is not a comparison of commercial values, although it is a comparison of the most important element in commercial values, namely, the energy wasted in doing equal work."

Mr. George H. Jones, of Chicago, said that the central-station company in Chicago has felt that the high-efficiency lamp is the one that its customers should have and the one that pays the best in the long run. In support of this assertion, he gave some interesting figures to show the average consumption of electrical energy from three classes of customers of the Commonwealth Edison Company in the month of October for the years 1908, 1909 and 1910. These figures may be tabulated as follows:

	October, 1908	October, 1909	October, 1910
Apartments	16 kw-hours	17 kw-hours	18½ kw-hours
Houses	30 "	32 "	33 "
Small stores	46 "	48 "	79 "

The increased demand for electricity from small stores, comparing October, 1910, with October, 1909, is remarkable. These figures show that the central station need not be afraid of the tungsten lamp; apparently, as the lighting becomes more efficient, the demand for electrical energy increases.

Mr. J. W. Howell, Harrison, N. J., said that the figures given in the table at the close of Mr. Randall's paper might be misleading, as the various types of lamps are not compared at their maximum efficiencies. To compare lamps properly each should be exhibited under its own most favorable conditions, giving also the first cost and the operating cost. Mr. Howell declared that the pressed-filament tungsten lamp has passed away. The drawn-wire filament has many advantages. It is a one-piece filament and it is also stiffer than the pressed filament. Another advantage is that it has only two heat-conducting contacts—those at the leading-in wires—the other supports being poor heat contacts. This is not the case with a pressed filament, and where that is used much heat is carried away by the supports. The drawn-wire lamp makes possible great improvement in large-size lamps, which are much better in quality than the pressed-filament lamps of the same size. Mr. Howell sought to impress on the engineers the great value of large-size incandescent electric lamps in the art of illumination. These lamps are also being improved very rapidly. He remarked, too, that the Gem lamp deserves much greater attention than it has received. The elimination of early breaking lamps is a valuable characteristic of the Gem. The speaker thinks the Gem is about three times as good a lamp as the ordinary carbon lamp and wonders why people do not use it when it only costs 10 per cent more than the regular carbon lamp. Large carbon and Gem lamps are still made and sold, because they are ordered; that is, lamps of 32 cp and more. This should not be the case; these lamps are back numbers and their use should be discouraged by engineers.

Mr. G. C. Webster, of Cleveland, referred to price cutting by manufacturers of carbon-filament lamps in the period from 1904 to 1907 and showed how the quality of the lamp suffered in consequence. If the engineers want quality and service, he said, they must give the manufacturer his price. Let the latter have at least ¼ cent per lamp to put into development work.

Mr. W. F. Little, of New York, made an exceedingly interesting demonstration of a lamp built in the Electrical Testing Laboratories to test the ruggedness or resistance to breakage of incandescent lamp filaments. The machine is so arranged that the lamp under test, while its filament is traversed by a very slight current, is subjected to repeated shocks or vibrations that are gradually increased in length. A dial is arranged to show at what length of vibration or "bump" the filament breaks. Mr. Little tested carbon lamps and pressed-filament and drawn-wire tungsten lamps in this machine, and the much greater ruggedness and strength of the filament of the last-named type were very clearly manifested. If, for instance, the pressed filament would break as the result of a blow of 0.6 in., the drawn-wire filament would withstand successfully a blow of 4 in. The demonstration was received with applause.

Mr. Macbeth said it was a great step in advance to have only one metallic filament in a lamp. The special advantage is due to the continuous filament from end to end.

Mr. F. A. Vaughn, of Milwaukee, said that illuminating engineers wish particularly to be imbued with confidence in relation to the various sizes of the drawn-wire lamp. The large sizes seem good, but how about the lamps smaller than the 25-watt size? How about the ruggedness and durability of these smaller lamps? This is important because the consumer demands these small lamps.

Mr. P. S. Millar, of New York, pointed out that the change in position of the light-giving source in the incandescent-lamp bulb due to the use of the drawn-wire filament has altered light-distribution curves. He also praised the progressive attitude of central-station companies like the Commonwealth Edison Company of Chicago in placing the tungsten lamp before customers on most advantageous terms.

Mr. T. H. Aldrich, of Chicago, spoke of the practical use of tungsten lamps in factories, where, as in the case of the factories of the International Harvester Company, they have been tested under adverse conditions. However, the engineers of this company have about concluded that the tungsten lamp is the most satisfactory form of illuminant that it can employ, and there are now between 12,000 and 13,000 in use in its factories, some of them operating

satisfactorily in rooms where there is a good deal of vibration. The average life is found to be 1500 to 1800 hours.

Mr. Randall, in closing, reviewed briefly the art of manufacturing incandescent lamps and showed the slow progress of the carbon lamp. He said that the table given at the end of his paper pretends to be nothing but one way of comparing progress in lamp development. The manufacturers are struggling, he said, to reduce the price of tungsten lamps. The table referred to ignores many variables. The incandescent lamp as an energy transformer is exceedingly wasteful. In relation to small-wattage lamps, Mr. Randall said it was largely a question of the size of the holes in the die through which the wire is drawn. If the die-maker can make a hole of 0.0001 in. in the diamond, the speaker believes that tungsten wire can be drawn through it. The 25-watt lamp is not as hardy as the 40-watt lamp, but in candle maintenance it will compare favorably with any other size. The speaker does not think it advisable to go to lower wattages than those now available for ordinary commercial illumination. He spoke of the new automobile lamp as demonstrating some of the special uses of the drawn-wire tungsten filament.

This concluded the Tuesday morning session, which lasted until 1:35 p. m. The remaining sessions will be reported in the *Electrical World* of next week. On Tuesday noon it was announced that the total attendance was 222. Of this number 130 were members of the society, about equally divided between local members and out-of-town members.

Toronto Meeting of the American Electrochemical Society.

The twentieth general meeting of the American Electrochemical Society was held in Toronto, Ontario, Canada, on Thursday, Friday and Saturday, Sept. 21 to 23. On Thursday there were professional sessions in the morning and afternoon in the Chemistry and Mining Building of the University of Toronto and on Friday morning another professional session at the Lambton Golf and Country Club. Nineteen papers were presented at the convention and most of these elicited an animated discussion. The policy of printing practically all papers in advance is producing good results.

The social features were greatly enjoyed, as is always the case with the meetings of the American Electrochemical Society. On Thursday afternoon there was a reception at the house of Lieutenant-Colonel and Mrs. J. B. Miller. There was a smoker in the West Hall of the university on Thursday night, when Prof. J. B. Kenrick gave a remarkable exhibition in glass blowing, followed by an entertainment by "Section Q" in the form of a very amusing electric-furnace farce, "The Electrocomical Lab." The occasion was very enjoyable. While the evening was in progress the returns of the anti-reciprocity election were coming in and the election crowd in the streets of Toronto was certainly interesting.

After the Friday morning session and lunch those who wanted to play golf did so on the beautiful grounds of the Lambton Golf and Country Club. During the whole meeting the weather was ideal. On the evening of Friday there was a subscription dinner at McConkey's.

The whole of Saturday was devoted to an excursion. At Hamilton the works of the Canadian Westinghouse Company and those of the Steel Company of Canada and at Dundas the transformer station of the Canadian Hydro-electric Commission were visited.

The number of members and guests registered was 120. While the number is smaller than at some recent meetings of the society, the Toronto meeting will be remembered by all who attended it as an exceedingly enjoyable and successful affair.

The first session was called to order on Thursday morning by the president, Dr. W. R. Whitney. In the temporary absence during the first session of the secretary, Dr. J. W. Richards, Mr. Carl Hering was made acting secretary.

Following are abstracts of the papers presented.

RECENT PROGRESS IN ELECTRIC IRON SMELTING IN SWEDEN.

The first paper of the meeting was presented by Mr. T. D. Robertson, who gave a very concise yet full account of the results obtained at the 2500-hp electric iron-ore reduction furnace of the Jerkontoret at Trollhättan, Sweden. The chief results are summed up as follows:

(1) Electric smelting of iron is no longer in the experimental stage, but in Sweden it is thoroughly established on a commercial scale. (2) The smooth and regular working of the furnace at Trollhättan has been a marked feature, probably less trouble being experienced than would have been the case with a blast furnace doing similar work. (3) The quality of iron produced for steel-making purposes has been shown to be equal and in some cases superior to that of Swedish blast-furnace pig iron. (4) The comparative costs of electric and blast-furnace smelting depend in general on the cost of suitable fuel and electrical energy, as the electric furnace simply substitutes one electrical hp-year for 2 metric tons of blast-furnace fuel. In Sweden there is no doubt that the electric furnace has come to stay on account of cheaper production. (5) The electric furnace is specially adapted to the smelting of finely divided ores or concentrates. (6) Electric smelting in Sweden has a national value, as its adoption will result in the development of water-powers which could not in many cases be profitably utilized for any other purpose.

The paper was discussed at some length by Messrs. Brady, Whitney, Simpson, Kohn, Hering and Lidbury.

AN UNSUCCESSFUL FURNACE EXPERIMENT.

In a paper by Mr. Francis A. J. FitzGerald were compared the heat losses in different electric-furnace designs, all of the same general type, the heat being produced by downward radiation from an electrically heated resistor at the top. The latest design gave disappointing results, since the heat losses were unexpectedly large. This is partly explained by the fact that in it the ratio between hearth area and total area receiving heat from the resistor was relatively small and that the ratio between the area of the surface, other than the hearth, receiving heat from the resistor and the rate of generation of heat in the resistor was relatively large.

The main point is to provide good heat insulation of the walls. If the heat insulation is good, then, while there may be a great difference in temperature between the charge on the hearth of the furnace and the resistor, there will be very little difference between the rest of the surface receiving radiation and the resistor, and hence the losses will be small. It was in this point that the chief weakness of the furnace showing high losses was found.

A communicated discussion by Mr. John Thomson, who had been the co-designer of the furnace, was read by Mr. Lidbury, while the president, Dr. Whitney, emphasized the importance of publishing an account of unsuccessful experiments for the lessons they teach.

TITANIUM IN IRON AND STEEL.

A paper by Mr. Charles V. Slocum emphasized the large extent to which titanium is now used in the iron and steel industry since Rossi succeeded in devising an electric-furnace process for making ferrotitanium. The methods of applying ferrotitanium in steel making and refining are described. The effectiveness of titanium is due to its deoxidizing powers, to its elimination of nitrogen and to the fact that it gives the slag greater fluidity so as to separate it completely from the metal.

There was a long discussion, in which Mr. FitzGerald,

Dr. Waterhouse, Dr. Whitney and Mr. Slocum participated, besides two communicated discussions by Dr. R. Moldenke on the use of titanium in foundry practice and by Dr. Hans Goldschmidt on his reasons for using a carbon-free ferrotitanium containing some aluminum.

NIAGARA TRANSFORMING STATIONS.

A paper by Mr. A. J. Jones on the "Transforming Stations of Niagara Electrochemical and Electrometallurgical Industries" gave an illustrated catalog of the electric equipment of the transformer stations at the different electrochemical plants on the United States and Canadian sides of Niagara Falls.

In the discussion Dr. E. F. Northrup referred to the successful use at the Massena plant of the Aluminum Company of America of a mercury ammeter (based on the pinch effect) measuring 14,000 amp regularly. Its rating is 16,500 amp, and no failure has occurred in continual service.

MOLYBDENUM STEEL DIRECT FROM IRON ORE.

A paper by Messrs. E. T. Dittus and R. G. Bowman gave an account of laboratory experiments carried out in the Colorado School of Mines on the production of molybdenum steel direct from iron ore in an electric furnace.

The furnace used could be operated either as a Héroult or a Girod furnace, the latter being found more advantageous in this case. The reduction of the iron ore to metallic iron is done in the usual way with coke as reducing agent. Just before tapping the steel a mixture of ferrosilicon and powdered molybdenite is added to the steel, producing the reaction $MoS_2 + Si = Mo + SiS_2$. In this way molybdenum is alloyed with the steel. Ferrosilicon is also effective as a desulphurizer of the steel. In the different experiments considerable difficulty was experienced in tapping the steel, and it is thought preferable to use a tilting furnace.

The paper was briefly discussed by Messrs. FitzGerald and Hansen.

ELECTRIC INDUCTION FURNACE.

The last paper of the morning session was one by Mr. Albert Hiorth, of Christiania, Norway, describing the design of a 30-ton induction furnace, based upon the data and results obtained with his original 5-ton induction furnace. The author deals at length with the calculation of the power-factor. In order not to get too low a power-factor two remedies are used in the 30-ton design: First, a three-phase induction furnace with three iron cores (instead of the single-phase system of the 5-ton furnace) is used and, second, the frequency is reduced from 13 cycles per second to 8 cycles per second.

Data are given on the power required to keep the charge molten at constant temperature. The dimensions of the furnace are worked out and details of the designs of the two furnaces are given in a numerical table and diagrams.

In a communicated discussion Mr. Unger pointed out that the power-plant installation would be costly on account of such a low frequency as 8 cycles per second. He thought it would be cheaper to combine a number of smaller units in one furnace. Mr. Hering pointed out the possibilities of reducing the heat losses by careful designs.

MINERAL RESOURCES OF ONTARIO.

The first paper of the afternoon session of Thursday was presented by Director T. G. Gibson, of the Bureau of Mines of Ontario. He gave an outline of the mineral deposits in the different portions of Ontario, with special reference to nickel, silver and gold, and suggested some important problems which might be solved by electrochemistry.

ELECTROLYTIC-COPPER DEPOSITION FROM SOLUTIONS CONTAINING ARSENIC.

A paper by Dr. Ching Yu Wen and Dr. E. F. Kern, of Columbia University, gives an account of an extended investigation of "the effect of organic and inorganic addition agents upon the electrodeposition of copper from electrolytes containing arsenic." The troubles due to arsenic contained in a copper-salt solution subjected to electrolysis are well known, and the object of the investigation was to prevent the deposition of arsenic on the cathode and to prevent the formation of dendritic trees. This problem was worked out, having in mind the production of solid and smooth deposits, from copper electrolytes containing a high percentage of arsenic by means of organic and inorganic "addition agents."

The best addition agents were found to be combined gelatine and sodium chloride (about 0.01 per cent to 0.02 per cent gelatine and 0.01 per cent Cl as NaCl), as the copper deposits thus obtained are smooth and of great ductility and high purity.

CONDUCTIVITY OF MIXTURES OF COPPER SULPHATE AND SULPHURIC ACID.

A paper by Prof. H. K. Richardson and Mr. F. D. Taylor, of Pennsylvania State College, gave the results of measurements of the conductivity of different-percentage mixtures of sulphuric acid and copper sulphate at 25 deg. C. and 45 deg. C. and of the temperature coefficient of conductivity.

Addition of copper sulphate to solutions of sulphuric acid increases the conductivity of the mixture if the sulphuric acid is less than 3 grams per 100 cu. cm, while it decreases the conductivity if the sulphuric acid is more than 3 grams per 100 cu. cm.

Owing to lack of space the remainder of the convention report is held over for the following issue.

Convention of Iron and Steel Electrical Engineers.

The Association of Iron and Steel Electrical Engineers met in annual convention at the Hotel Imperial, New York City, Sept. 25-30. The sessions were held in the reception room on the second floor of the hotel, and the officers expressed gratification at the attendance, which exceeded the comfortable seating capacity of the room, the registration being as we go to press about 160. As is probably well known by our readers, the object of the association is to further continuously the improvement of apparatus and machinery used in the iron and steel industry, and to bring together once a year the manufacturer and the consumer, so as to enable an interchange of ideas and the combination of the experience of the latter with the skill of the former. Unfortunately, the by-laws of the association will not permit of the publication of abstracts and discussions prior to the issuance of the proceedings, so that only general characterizations of the papers will be permitted at this time. The complete program of papers and events was published in last week's issue, and was carried out with the exception of a paper on "Electric Furnaces" by a representative of the Swedish Chamber of Commerce; one on the "Mechanical Design of Cranes," by Mr. C. A. Kafer, of the Bethlehem Steel Works, and one on "Alternating-Current Versus Direct-Current Cranes," by Mr. K. A. Pauly, of the General Electric Company, all of which were withdrawn.

Monday's session was given over to a consideration of the report of the safety committee, which contained information regarding rules, signs and appliances relative to safety such as have been installed and adopted at various works, together with suggestions relative to safety which might be worthy of adoption. Nothing definite was suggested by the committee, the report being a forerunner of another to follow next year.

At Tuesday morning's session Mr. F. W. Woodhull, of the Luken Iron & Steel Company, showed a number of lantern slides and described safety devices used in the iron and steel industry. Following this lecture, Mr. C. T. Henderson, of the Cutler-Hammer Manufacturing Company, read a paper on "Dynamic Safety Stops for Electric

Cranes." The author pointed out that dynamic braking has been almost universally used in ore and coal handling machinery, and that it could also be and has been applied to the steel industry. He described the principles involved, and pointed out the merits of the drum type of controller as opposed to the face-plate type of controller for this service.

CONTROL APPARATUS FOR STEEL MILLS.

At the afternoon session Mr. M. A. Whiting, of the General Electric Company, presented a paper on "New Developments in Control Apparatus for Steel Mills." The company had already described its direct-current and alternating-current contactors, and the current limit system used with these two lines of contactors, at a previous convention of the association. The developments have been chiefly in the direction of improved forms of auxiliary devices, and in the design of a normally closed contactor in which the contacts are held closed by spring pressure and opened by the application of voltage to the operating coil. These contactors are used to provide emergency dynamic braking in case of failure of the circuit, under which condition the controlling contactors as a rule will drop out. The greater portion of the paper was devoted to a description and applications of the series contactor for reversing and non-reversing equipments.

AUTOMATIC CONTROL FOR DIRECT-CURRENT MOTORS.

The second paper at Tuesday afternoon's session was presented by Mr. A. C. Eastwood, of the Electric Controller & Manufacturing Company, on "Automatic Control for Direct-Current Motors." The paper described in detail a form of magnetically operated series switch brought out by the company, which is combined in various ways in the construction of automatic starters and controllers for different purposes. The valuable features of the combined series switch and relay were brought out in connection with numerous applications already in extended use, and the author felt that the series-wound switch will, to a very great extent, revolutionize the art of automatic motor control.

DIRECT-CONNECTED REVERSING MOTOR FOR ROLLING MILLS.

Mr. G. W. Richardson, of the American Bridge Company, read a paper on "Direct-Connected Reversing Motor Planer Drive," in which he pointed out that to drive a planer reversing with every stroke, from the shortest to the full stroke of the planer, it is necessary to employ a very low-speed motor, an automatic controller and to use dynamic braking to stop the table so that there will not be counter-electromotive force at the time the applied electromotive force is applied to the armature of the motor at the moment of reversal. This must be so arranged that the dynamic braking relay is off at the moment the applied electromotive force is connected, and that dynamic braking will take effect at the moment the applied electromotive force is withdrawn. He described an application of a double-armature, 50-hp, 220-volt motor on a 120-in. planer, which was very satisfactory and showed a saving of approximately $700 a year, not counting delays to work, over the former belt drive.

TRANSFORMERS FOR STEEL MILL SERVICE.

The final paper at the afternoon session was read by Mr. H. C. Soule, of the Westinghouse Electric & Manufacturing Company, and was entitled "Transformers for Steel Mill Service." The author gave a very general treatment on standard transformers, for, of course, those intended for steel-mill service are not different from standard. He championed the shell-type transformer as possessing the most solid construction, but this statement was challenged by representatives of manufacturers building the butt-jointed and lap-jointed core-type transformers.

ELECTRIC CRANES FOR STEEL MILLS.

There was to have been a lecture on Tuesday evening by Mr. R. J. Young, of the Illinois Steel Company, on "Safety," but this lecture was postponed until the Wednesday morning session. Although there were four papers scheduled for Wednesday morning, only one was presented owing to the time taken up by the lecture by Mr. Young. This paper was entitled "Electric Cranes for Steel Mill Service," and was prepared by Mr E. Friedlaender, of the Carnegie Steel Company. The author did not take up the questions of design of girders, gears, motors, controllers, etc., but confined himself to a few points relative to electric crane construction and operation, so as to bring out discussion on many important features. He showed that the total mechanical efficiency of electric cranes hardly exceeds from 65 to 70 per cent, and together with electrical losses in motors, controllers and conductors, the over-all efficiency is brought down to from 50 to 60 per cent. He advocated taking the speed control of crane motors out of the hands of operators, and to predetermine acceleration, speed, torque and current through magnetic switches. Mr. Friedlaender stated that, inasmuch as normal load hardly ever exceeds one-quarter maximum load, the speed should be made to suit the normal load, and the work in foot-pounds should then be made the same for the maximum load. For this service series direct-current motors are better adapted than alternating-current motors and possess a better working efficiency. The author drew attention to the fact that cranes are generally handled more roughly than any stationary machinery, and said that the use of energy at potentials over 275 volts could not be recommended because the accidental touching of conductors would probably prove fatal. Ordinary commercial motors have been found unsatisfactory for the trying conditions met with in crane work, and special mill-type motors have been developed and the characteristics of these were pointed out. Poor commutation of high-peak currents has always been a defect of crane motors, which has been more or less mitigated by the introduction of interpoles. The author claimed that the usual practice of rating railway motors after one hour's full load run, with a maximum temperature not to exceed 75 deg. C. above that of the surrounding air, should be adhered to in most instances for crane work, especially upon bridge and trolley motion. The alternating-current motor has encroached more and more into the field of the direct-current motor, and successfully replaced the latter where speed and direction of rotation is constant, but the introduction of alternating-current motors for crane work has been slow for reasons which the author enumerated at length.

The first topic taken up at Wednesday afternoon's session was a paper on "Track Wheels for Electric Cranes," by Mr. W. D. Snyder, of the National Tube Company. This was followed by a paper by Mr. T. E. Tynes, of the Lackawanna Steel Company, on "Methods of Lubrication for Electric Cranes." These two papers were scheduled for presentation at the morning's session, and dealt with matters of no electrical interest.

MOTORS FOR STEEL MILL SERVICE.

At the afternoon session Mr. B. Wiley, of the Westinghouse Electric & Manufacturing Company, presented a paper on "Recent Development of Motors for Steel Mill Service." During the past year his company has completed the development of three new lines of motors for industrial work, which are particularly suitable for various classes of steel-mill applications. These include a direct-current, commutating-pole motor for continuous service, a direct-current, commutating-pole motor for heavy intermittent service and an alternating-current, high-torque, wound-rotor type of motor designed to withstand the severe service conditions in iron and steel mills. The principal features and applications of the motors were pointed out.

ALTERNATING-CURRENT VERSUS DIRECT-CURRENT MOTORS.

One of the most interesting papers presented at the convention was prepared by Messrs. B. R. Shover, of the Carnegie Steel Company, and Edward J. Cheney, of the

General Electric Company, and was entitled "Cost and Efficiency of Alternating Versus Direct-Current Motors for Steel-Mill Auxiliaries." The authors stated that there was no question but that induction motors should be used for driving the main rolls and that induction or synchronous motors should be used for pumps and other apparatus about the plant where large motors are necessary. There is, however, a diversity of opinion as to whether the so-called auxiliaries should be driven by alternating-current or direct-current motors. A comparison is made between a straight alternating-current system and a mixed system of alternating-current and direct-current motors, and from a study of sixteen cases the authors arrived at the following conclusions:

(1) The all alternating-current system costs slightly more than the mixed system. (a) Excess first cost higher for 22,000 volts transmission than for 6600 volts. (b) Excess first cost higher for gas engines than for turbines. From which it appears that the higher the first cost of power supply the less favorable is the use of the all alternating-current system. (2) The lower the power-factor the greater is the excess cost of the all alternating-current system for both percentages of auxiliary load. (3) The less the percentage of auxiliary load the less the excess cost of the all alternating-current system for both power-factors. (4) The annual costs of the all alternating-current system considered are lower than those of the mixed system. (5) The actual operating costs—that is, excluding interest, depreciation, taxes and insurance of the all alternating-current system—are considerably less than those of the mixed system. (6) The excess cost of maintenance of the mixed system is based on an estimate and not on actual records. Should this item be entirely neglected the results in nine out of sixteen cases would show an excess of annual costs for the all alternating-current system, but the amount is so small that accurate calculations for any individual case would be necessary to determine the relative advantages. (7) When the saving in output due to the fewer delays in the all alternating-current system is taken into consideration the saving in annual costs will be largely increased, and even should the difference in motor maintenance be neglected there would still be a considerable saving in annual costs for the all alternating-current system.

For a rolling mill properly motored, where there are no problems of electric drive which have not been successfully solved by the use of alternating-current motors, where the percentage of power required for auxiliary apparatus (exclusive of pumps, etc.) is 25 per cent or less of the total power delivered to that mill and where the power-factor of the entire mill, including both main and auxiliary apparatus, is 70 per cent or over, the authors feel amply justified in saying that the all alternating-current system will show a saving in annual cost, to say nothing of its greater simplicity and more satisfactory operation.

ELECTION OF OFFICERS.

On Wednesday evening a banquet was held in the large reception room on the main floor of the Imperial Hotel, covers being laid for 125. Letters of regret were read from Mr .Charles Nagel, Secretary of the Department of Commerce and Labor; Mr. Charles P. Neill, United States Labor Commissioner; Dr. W. Wilson, Governor of New Jersey; Mr. A. C. Dinkey, president of the Carnegie Steel Company, and Mr. E. A. S. Clark, president of the Lackawanna Steel Company . The speakers at the banquet included the following: Mr. R. C. Bolling, assistant solicitor of the United States Steel Corporation; Dr. S. S. Wheeler, Crocker-Wheeler Company; Rev. J. McDowell, Newark, N. J.; Mr. C. T. Henderson, Cutler-Hammer Manufacturing Company; Colonel Andrews, General Electric Company; Mr. F. R. Hutton, American Museum of Safety; Mr. F. P. Townsend, past-president of the Association of Iron and Steel Electrical Engineers, and Mr. McConnahey, of the Pittsburgh Central Y. M. C. A.

The result of the election was announced at the banquet as follows: President, Mr. B. R. Shover, Carnegie Steel Company; vice-president, Mr. E. W. Yearsley, Midvale Steel Company; second vice-president, Mr. E. Friedlaender, Carnegie Steel Company, and secretary-treasurer, Mr. James Farrington, LaBelle Iron Works. The convention was still in session when we went to press.

Convention of Association of Edison Illuminating Companies.

The twenty-seventh annual meeting of the Association of Edison Illuminating Companies was held at the new Monmouth Hotel, Spring Lake Beach, N. J., Sept. 19, 20 and 21. The decorations prepared for the conference of Governors of states held the week before at the same place and hostelry were still in evidence, and the 350 attendants at the convention, under the inspiration of delightful autumnal weather, helped to kindle anew the life of the resort, whose season had already ended. In many respects the meeting was noteworthy. Not only was the attendance the largest ever recorded, but for the first time in the history of the association engineers of the Westinghouse Electric & Manufacturing Company were present during part of the sessions. The association also acted as host to the president of the Institution of Electrical Engineers, Mr. S. Z. de Ferranti, of Sheffield, England, who was accompanied by Mrs. de Ferranti, Mr. Charles H. Merz, of London; Mr. Arthur Wright, of the same city, and Mr. H. A. Couves, of Newcastle.

As has been the custom in past years, none but the elect were permitted to take part in the deliberations of the association. The sessions were held in the ballroom of the hotel behind closed doors and the press committee passed on all matter issued for publication. Needless to state none of the discussion was included in this matter, the idea of the association being that only in this way can a free and frank discussion be conserved. The delegates were provided with printed papers, but some of the most important ones were read from manuscript. Included among the latter were the following: "Thermal Application of Electricity," by Dr. William Stanley, of Schenectady; "Report of the Committee on Incandescent Lamps," by Mr. J. W. Lieb, Jr., of New York; "Improvements in Incandescent Lamps," by Mr. J. Howell, of Harrison, N. J.; "Test of Large Boiler Units at the Detroit Edison Plant," by Dr. D. S. Jacobus, Hoboken, N. J. In addition there were two addresses made on Thursday evening, one by Mr. Arthur Williams, of New York, on industrial movements abroad, and the other by Dr. C. P. Steinmetz on the nature of electrical energy. Dr. Stanley's remarks dealt with investigations in electric heating apparatus which are at present being made by the General Electric Company. Dr. Jacobus gave advance information on tests made on the huge boilers with which the Delray plant of the Detroit Edison Company is equipped, full details of which will be given in a paper to be presented before the American Society of Mechanical Engineers. From what could be gathered the association is satisfied with the present situation in the lamp industry.

ENTERTAINMENT FEATURES.

Entertainment was not lacking throughout the week. The association monopolizing the entire hotel, social life was almost homelike, and when the hotel did not suffice a large tent outlined within and without with incandescent lamps and situated in front of the hotel was pressed into service. There a splendid vaudeville entertainment was given on Tuesday night and in it on Thursday night a clambake was served. On Friday a fishing excursion was provided for those who remained after the closing session. and what with tennis, golf, automobile trips, teas, dances, etc., just enough time was allowed for eating and sleep.

ELECTION OF OFFICERS.

At the closing session the following officers were elected: President, Gen. George H. Harries, of Washington, D. C.; vice-president, Mr. Arthur Williams, of New York; secretary, Mr. T. T. Edgar, of Seattle, Wash.; treasurer, Mr. Louis Ferguson, of Chicago. The executive committee comprises the following: Messrs. G. H. Harries, S. Insull, C. L. Edgar, J. W. Lieb., Jr., J. B. McCall, W. W. Freeman, A. Williams, L. A. Ferguson and H. W. Edgar.

Gen. George H. Harries is a national figure in the electric light and traction industries. Although a Welshman by birth and education, he has served his adopted country well and long. While yet a lad he toured the Canadian Northwest and spent many active years on the plains and

PRESIDENT-ELECT GEN. GEORGE H. HARRIES.

in the mining regions. His Western life brought him into intimate contact with the Indians and made him so familiar with the traits of the redman that President Harrison appointed him a member of the Sioux Commission in 1891. Before the late Spanish war he was commissioned by President McKinley to the command of the brigade of the National Guard at Washington and during the war he was in command of a regiment of infantry from the District of Columbia. General Harries' first connection of note with the railway industry was as president of the Metropolitan Railroad Company, Washington, to which office he was elected in 1896. Returning from the Spanish war, he revoted his attention to lighting and traction work and in January, 1900, became a member of the board of directors of the newly organized Washington Traction Company, a tentative aggregation of railway and electric light corporations. Six months later he became vice-president of the organization now known as the Washington Railway & Electric Company, which controls the Potomac Electric Power Company, the Great Falls Power Company and the street railway systems of Washington. General Harries is treasurer of the National Electric Light Association and was for two years vice-president of the Association of Edison Illuminating Companies. He is also second vice-president of the American Electric Railway Association, chairman of its federal relations committee and a member of its public relations committee. In addition General Harries is a member of the Washington Society of Engineers and the Illuminating Engineering Society and an associate member of the American Institute of Electrical Engineers. He is also widely interested in affairs other than engineering in Washington. General Harries is fifty-one years old.

PRESIDENT'S ADDRESS.

The address of the president, Mr. Thomas E. Murray, of the New York Edison Company, was replete with information on modern practice in the design and construction of steam-driven electric-power plants. The author has brought together valuable power-station data of a comparative nature which are included in the address, and altogether the entire subject of design is treated in a manner which makes the address a valuable contribution to technical literature.

Mr. Murray, after some general remarks, took up in detail the power-station structure, the generating apparatus, prime movers, auxiliary apparatus, electrical equipment and operating costs. The treatment was devoted entirely to large stations representing the very highest type from the standpoint of reliability of service, operating economy and structural excellence. Larger boilers are coming into vogue and the evolution of boiler furnaces is such that fuels heretofore considered worthless can now be burned to advantage. Stokers are less automatic but more efficient than formerly, and the growing scarcity of steam sizes of anthracite, rendering a greater use of bituminous coal necessary, carries with it a wider adoption of the mechanical stoker. The steam-piping systems now in use are designed on the unit system with interconnecting mains and steam speeds of 12,000 ft. a minute. Steam pressures still remain between 175 lb. and 200 lb. and the use of superheated steam is becoming more general. A great improvement in boiler feeding has followed the use of the centrifugal pump and accurate water meters, and open heaters and forced draft are most widely employed in later stations. The steam turbine has supplanted the reciprocating engine in large stations and the author doubts if any more large reciprocating units will be installed for power-station purposes. Coming to the electrical equipment, the author shows that the design is largely influenced by the character of the load and the distance to which energy is to be transmitted. The conditions governing the size of the units and the voltage are also discussed. In busbar arrangements standard practice favors the group method of generator and feeder connections having two sets of busbars sectionalized at one or more points by switches. For bus and switch compartment work concrete is coming largely into use, but brick makes a more finished construction, while for high-tension switches and for flooring high-tension compartments soapstone is still the best available material. The improvements made in protective devices and instruments for switchboards are noted by the author, as well as methods of control which have worked well in practice, especially in stations having system operators or load dispatchers. Under the caption of operating costs Mr. Murray states that at the present time attention to station economics with large units and careful design has resulted in a station cost which is gradually approaching a minimum. He divides the cost of a fair-size station per kilowatt as follows:

	Per Cent.
Building structure	30
Boilers, furnaces and boiler-room auxiliaries	20
Turbines, generators and condensers with auxiliaries	25
Piping systems	10
Switchboard and other electrical work	7
Miscellaneous small items not otherwise included	8
Total	100

The importance of striving after a low cost of construction per kilowatt of station capacity will be appreciated when it is considered that the effect of a saving in the station investment cost of $5 per kilowatt is equivalent to an annual saving in the coal bill of 12 cents with coal at $3 a ton, where a fixed annual charge on the investment of 14 per cent is allowed to cover interest, depreciation and taxes. It would appear according to the author that further improvements must come from advances in the direction of reduction in cost, increase of output and an improvement in the load-factor under which the stations operate, rather than in the efficiency of the individual units.

Abstracts of the papers presented at the meeting will appear next week.

Convention of Northwest Electric Association.

The 1911 convention of the Northwest Electric Light & Power Association assembled in the "Hall of Doges," at Spokane, Wash., Thursday, Sept. 21, at 10 a. m., with an attendance of approximately 200 members. President Douglas Allmond introduced the Hon. W. J. Hindley, Mayor of Spokane, who delivered the address of welcome.

Mayor Hindley dwelt on the important part the electrical industry plays in the world's work and the consideration it is entitled to for the labor, brains and capital put into the various electrical enterprises. He took up the question of public-service corporations and the municipalities, stating that, inasmuch as they had prepared the soil, planted the trees and taken care of them until they bore fruit, they were certainly entitled to a just return for the fruit. He stated that the endeavor should be to strike a happy medium, so that the public-service corporation and the public itself would each receive what it is justly entitled to—the company a fair return on its investment and the people proper service at reasonable rates.

The Mayor's speech was followed by a short address by the president, who complimented Mayor Hindley on the fairness of his address, stating that it was the broadest speech he had yet heard on the subject, and coming from the representative of Spokane's commission form of government made it decidedly more important. A vote of thanks was tendered Mr. Hindley by the convention. The president then discussed briefly the disposing of unjust legislation and urged that all members show more interest in this matter, giving to the secretary of the association every assistance possible to cope with it successfully.

The report of the treasurer showed total receipts of $3,915 and disbursements of $2,513 to Aug. 31, 1911, leaving a balance of $1,402. Treasurer N. W. Brockett stated that the association had lost only six members during the past fiscal year, these members being lost by reason of consolidation with other companies, and that eight new members had been taken in to offset the six lost.

RATES.

The chairman of the committee on rates, Mr. N. C. Osborn, of the Washington Water Power Company, Spokane, delivered a short talk on rates. He mentioned the fact that different states are now represented by public-service utility commissions, which regulate the rates, etc., of public-service corporations, and exhibited the published rates, charts, etc., of the Washington Water Power Company, giving blackboard illustrations of the rates. Mr. A. A. Lewis, assistant to Mr. Osborn, gave examples and explained the rates in detail.

LEGISLATION.

At the opening of the afternoon session on Sept. 21 the president asked for the report of the legislative committee appointed at the last convention of the association, consisting of a representative each from the States of Oregon, Washington and Idaho. The representative from Oregon stated there was nothing of particular interest to report from that State. The representative from Idaho not being present, Mr. M. C. Osborn stated that the State of Idaho had passed at the last session of the Legislature a law that would create public-service commissions in communities and municipalities with rate-fixing power. This action was killed by the committee in the beginning and again taken up at the last moment just before adjournment and passed. It was, however, vetoed by Governor Hawley, who stated as his reason for such veto "that a commission appointed in communities in such a manner could not be a fair commission; that one could not secure five men from any community who would not be in some way personally interested."

Mr. N. W. Brockett, chairman of the legislative committee, then delivered an address on the work accomplished in the State of Washington. He stated that two important measures were passed, the public-utilities bill and the employees' compensation act. From the first of these measures were stricken most of the redeeming features which were introduced into the original draft, on account of the activity of the committee. In the latter measure were included all of the provisions contained in resolutions adopted at the last convention of the association.

DISTRIBUTION PROBLEMS.

In a paper by Mr. John B. Fisken certain problems encountered in the transmission and distribution of energy throughout the northwestern part of the United States were treated in detail. The subjects discussed related to the methods of transmission from outside points, method of generation, methods of operating generating stations and city substations, methods of distribution in cities, load dispatching and the education of employees. Much information was given concerning the constructive features and operating experiences of the Washington Power Company, Seattle-Tacoma Power Company, Portland Railway, Light & Power Company, the city of Seattle and the Seattle Electric Company. Both aluminum and copper are used for conductors, but the mileage of aluminum is much in excess of that of copper. The general practice is to erect the telephone lines on the same poles as the transmission conductors, and in normal operation this method is perfectly satisfactory. All of the companies lay down rigid rules for the guidance and protection of their patrolmen, and in all cases high-tension lines are short-circuited and grounded before anyone is allowed to work on them. A great deal of trouble has been experienced on account of the burning of pole tops. The only explanation which seems to cover the facts is that the heat due to the charging current starts a smoldering fire in the poles. In order to overcome this trouble all of the pins are now being grounded. For lightning protection the tendency is to discard the multi-gap type and replace them with aluminum cells. The city of Seattle is using two spark-gaps in series with a 2-in. column of running water as a resistance to ground. The Washington Water Power Company is the only one employing a ground wire strung above the conductor. The standard frequency employed is 60 cycles per second. With the exception of the Portland Railway, Light & Power Company, which has four steam turbines and seventeen steam engines, the Washington Power Company, which has two steam turbines, and the Seattle-Tacoma Power Company, which has one steam turbine and one steam engine, the energy is furnished by hydraulic turbines, of which twelve of the vertical type and thirty-one of the horizontal type are in use. In all of the recently equipped plants use is made of the indirect type of waterwheel governor, in which oil acting under pressure is employed to operate the gates.

A written discussion of Mr. Fisken's paper was submitted by Mr. S. C. Lindsay, who described the system and practice of the Seattle Electric Company, which operates a 60-mile, 50,000-volt line for transmitting energy from the Electron plant to Seattle and Tacoma. The conductors for the Electron line are 4-0 stranded copper, with the exception of 11 miles of one line, which is of No. 1-0 solid copper. The company operates 39 miles of 13,800-volt, three-phase line in the city of Seattle, 13 miles of which is aluminum. It has also 5 miles of aluminum railway feeders. The only objections against the use of aluminum for line conductors are that it has no scrap value and that linemen experience difficulty in making good joints between it and copper Although lightning is almost unknown in the Puget Sound region, the company makes use of lightning arresters for taking care of disturbances due to switching, short-circuits, etc. Grounded wires are not used along the transmission line, because it is not considered necessary to protect the line against lightning. The alternating-current generators are equipped with non-automatic breakers, the operator being depended upon to open the switch on the unit in case

trouble arises. All of the transmission lines are equipped with automatic oil switches in the stations where the lines originate. Mr. Lindsay expressed the opinion that it is best to make practically all transmission-line breakers, as well as generator breakers, non-automatic, and to confine the use of automatic switches to the distribution circuits. In connection with its steam station in Seattle the company operates a steam-heating system for about eight and a half months of the year. A load dispatcher is employed for regulating the load on the engines, so that the exhaust steam will equal the amount of steam necessary to meet the requirements of steam-heating. There are over 300 steam-heating customers, with a total connected radiation of approximately 248,000 sq. ft. The rates charged vary from 77 cents per 1000 lb. to 55 cents per 1000 lb., according to the amount used.

At the conclusion of the reading of the papers by Messrs. Fisken and Lindsay an open discussion took place concerning them. The principal points taken up were the use of leased telephone service on transmission lines, in addition to company telephone service, to avoid discontinuance of communication between generating points and central station, etc.; the grounding of wires to avoid loss and damage by lightning disturbances; the life of poles, cross-arms, etc., and the preserving of native timber to take the place of that now imported; cost of construction of lines; the forming of clubs by members of a company, for the betterment of service and the bringing of officials in closer touch with employees; the improving of central stations and other properties to obtain better work and results from employees.

PUBLICITY.

"Central Station Publicity and Commercial Policy" was the title of a paper by Mr. W. J. Grambs. The author claimed that it is to the financial advantage of the public-service corporations to cultivate the good will of the public. The right of the public-service corporation to do business comes from the people, its income from service comes from the people, and its prosperity rests upon the good will of the people. Public-service commissions, when created along the right lines, can do much to create a fair understanding on the part of the public concerning the problems that central stations have to solve, and can thereby assist the corporations in improving and lowering the cost of service. Such commissions are created for the purpose of regulating the public-service corporations, but it must be borne in mind that it is no less their duty to protect the public-service corporations against unjust imposition of burdensome regulations and taxes. Control regulation is here to stay, and the time will come when commissions will make the same effort to be fair with corporations that the corporations are now striving for in dealing with the public. Commissions should stop at control and regulation; they should not manage, operate or dictate what the management or operation should be beyond efficiency and economy. Commissions should pass judgment upon matters of justice and fairness, but not upon matters of technical detail. There is a possibility that part of the general prejudice against utilities corporations might be removed if the central station published an annual financial statement with a reservation for maintenance and possible extensions, in this way taking the public into its confidence.

In its dealings with the contractor the central station should meet him more than half way. The contractor or engineer is the person who advises the owner concerning the installation of a private plant or obtaining service from the central station. It is necessary, therefore, to cultivate the friendship of electrical contractors and engineers. If the central station treats the contractor fairly and generously the contractor will in most cases give to the public the impression that it may also expect the same kind of treatment from the central station.

Owing to lack of space, the remainder of the report of the convention is held over for the following issue.

Convention of Kansas Electric Association.

The fourteenth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association was held at Independence, Kan., Thursday and Friday, Sept. 21 and 22, with President W. R. Murrow, of Independence, in the chair and a total registration reaching nearly ninety. Mayor Frank Moses welcomed the convention to the city in a happy speech, the response to which was made by Prof. B. F. Eyer, of Manhattan, Kan.

The technical program was opened with a paper on "The Use of Potential Feeder Regulators on Distributing Systems," by Mr. A. D. Fishel, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Mr. Fishel outlined the advantages of maintaining voltage regulation, mentioning the increased sale of energy, improved illumination with satisfied customers, decrease in lamp renewals and increased economy of operation. The increased sale of energy, he declared, will well repay the cost of automatic regulation. Automatic regulating apparatus of the induction type was then described in detail, the paper closing with an account of the very large high-voltage, three-phase, oil-insulated, self-cooling regulators recently brought out by the Westinghouse company.

Secretary-Treasurer James D. Nicholson, of Newton, followed with his official report, enumerating the association membership, which is made up of ten honorary, 114 active and fifty-four associate members. His report on the organization's treasury also showed the association to be in equally comfortable circumstances financially.

COMBINATION ICE-MAKING.

Mr. W. E. Sweezey, of Junction City, Kan., gave an interesting talk on ice-making for central stations gained from his own experience of nine years' operation. The combined operation of the two plants makes use of practically uniform requirements of coal and labor, he said, decreasing the kw-hour cost during the light-load summer period to a point equal to the fully loaded winter-output unit cost. These facts he illustrated by figures and offered practical advice on the selection of motive power for compressors. The subject was also discussed by Prof. B. F. Eyer, of Manhattan.

Mr. Sweezey then read a paper prepared by his wife, who was unable to be present, on the subject of electric cooking. Recounting her own experiences, Mrs. Sweezey told of the appetizing preparation of less expensive foods possible with electric heat and gave the cost of operating her own electric range in every-day use.

KANSAS UTILITY COMMISSION.

Mr. Carl C. Witt, chief engineer of the new Kansas public-utility commission, followed with a discussion on the relation of that body to the companies. Regulation of public utilities, he declared, will result in an increase of the public's confidence in these corporations in the same way as in the case of the banks which undergo inspection and now find it immensely to their business advantage, although the first efforts at banking regulation were resented by them. The new corporation commission will be the means of saving much costly litigation, said the speaker, and will avoid the evils of the lobby system. The commission as constituted in Kansas becomes a kind of court from which prompt decisions, based on expert knowledge, may be expected. Where necessary, as shown by the cost of the service rendered, the utility commission expects to raise rates, proving its position so that no criticism or objections will follow from the public. A system of uniform accounting is regarded as important to enable the commission to carry on its investigations. Another function of the commission will be the prevention of needless duplication of plant equipment by competing companies, which will not be permitted to enter into competition in a field already satisfactorily filled. Mr. Witt recounted instances of economically expensive water and telephone plant duplications which would

have been impossible under proper supervision of a commission.

Prof. B. F. Eyer, who is vice-president of the Manhattan (Kan.) company, said that under proper administration state regulation will be welcomed by the Kansas plants, eliminating as it will dead losses and useless competition. Mr. C. E. Marsh, of Garden City, told of the recent campaign in his own town, which resulted in the voting of a competitive municipal plant, in spite of the good service rendered by the existing company. Mr. C. L. Brown, of Abilene, said that the public must be educated to the facts of public-utility businesses and added that the interests of the companies are better guarded in the hands of the well-qualified and expert commissioners than when resting with the stove-box politicians, as formerly. While, declared Mr. Brown, the desire of a community to operate its own electric plant may be thoroughly proper and admissible, it should, instead of erecting a plant to compete with the one already in service, be required to purchase the latter at a fair appraisal of its value. Mr. W. E. Sweezey, of Junction City, pointed out that even where the commission does not regularly have authority it may be appealed to from the decisions of local officials. Mr. J. H. Rathert, of Junction City, said it is often impossible to educate the public to the community's best interests.

ACCOUNTING AND COLLECTIONS.

Mr. Ivor Thomas, of Wichita, opened the afternoon session with his paper on "Accounting." Mr. Thomas is by birth an Englishman, having recently served as an accountant in the British colonies of South Africa, and several interesting points in his paper compared central-station business methods in America and abroad. In England, he said, the responsibility for an unpaid lighting bill lies with the owner of the house, which cannot be rented again until the account is settled. American companies, declared Mr. Thomas, write off too much as uncollectible bad debts, a source of loss which, he said, he believed could be decreased. He also deplored the American precedent by which a combination company will continue to furnish gas to a defaulting customer who has failed or refused to pay his electric bills. Tactful collectors, he asserted, can retrieve many losses which companies now suffer. Persons otherwise highly moral often consider it not dishonest to defraud corporations. To apprehend those who make a practice of moving from one town to another leaving unpaid bills behind, Mr. Thomas proposed the organization of a national collection agency to which all central stations and utility companies might subscribe.

Mr. Thomas's reference to defaulting customers provoked a discussion on the subject of meter deposits, customer connection charges, etc. Mr. Slayton, of Wichita, said that the loss of so many meters has caused his company to require a deposit or the signed guarantee of some property-holder, although, he added, he suspected the latter guarantor could not legally be held responsible. Mr. M. T. Flynn, of Kansas City, said he had also used the guarantee-slip plan, and Mr. C. D. Braden, of Kansas City, Mo., said that while operating a plant he found the best plan that of cutting off customers promptly when their bills lapsed beyond a certain date. Under these conditions the meter would be left in for a few days and the customer soon appeared to pay his bill and to apply for restored service. For reconnection no charge was made, the application being treated as from a new customer. Mr. Braden reported that no customers were ever lost as a result of thus promptly cutting off service and he protested against allowing bills to run on as being productive only of future trouble on a larger scale. In Kansas City, Mo., $5 deposit is required, and all bills must be paid within ten days on penalty of discontinuance of service, the cost of reconnecting which is $1.50. Mr. A. C. Brown said he made a practice of charging a fee of $5 for running each service, these fees being permanently retained by the company. Mr. Clyde Crummel, of Independence, said that the local gas company requires a deposit of $5, on which it pays 5 per cent interest.

Mr. W. E. Sweezey, of Junction City, said he finds the system of deposits of chief service in notifying the company when customers are preparing to move, as they then never fail to call and collect their deposit money. Otherwise the office may remain ignorant of the change in occupants of the house and be put to some difficulty in apportioning the cost of service used between the former and later occupants. In St. Louis, said Mr. Gordon Weaver, of Kansas City, a regular deposit is required of all customers not property owners, the amount of the deposit being based on an estimated one-month bill. Fifteen days after the bill remains unpaid the company disconnects its service, the charge for restoring which is $5.

Secretary Nicholson, of Newton, said that recently when a former customer left his town with an unpaid electric bill he wrote to the company in the city to which the defaulting consumer had gone and when the later applied for electric service he was met with a statement of his debt in Newton. As a result the Newton debt was paid before the local application was made, but the speaker added that, in strict legality, he believed a public utility might not refuse service to an applicant who owed bills to another company. Referring to the practice of the Commonwealth Edison Company, of Chicago, another speaker said that while this company requires deposits only from those who are unknown to it such deposits earn 6 per cent interest for their owners while in the company's hands.

ILLUMINANTS AND LIGHTNING ARRESTERS.

Under the title of "The Choosing of Lamps for Electric Lighting" Mr. Evan J. Edwards, of the National Electric Lamp Association, Cleveland, Ohio, next presented a paper of unusual practical and academic interest describing the manufacture and uses of modern types of tungsten lamps and their operation at the various pressures of the three-voltage rating, and closing with an account of some interesting considerations of lamp efficiency, color quality, distribution and diffusion, etc.

Besides discussing the grounding of transformers, use of ground wires on transmission lines, etc., Mr. Gordon Weaver's paper, which followed, gave an account of the classical series of lightning-arrester experiments carried out by Mr. E. E. F. Creighton and others on a 25,000-volt system at San Juan, Col., several years ago. Mr. Weaver took part in these experiments, which included tests of liquid-electrolyte, aluminum-cell and multi-gap lightning arresters. In discussing the effect of transformers to absorb surges in distribution lines Mr. A. D. Fishel, of Pittsburgh, Pa., said that while such transformers may decrease the protection required lightning arresters will nevertheless still be needed.

THE KANSAS WORKMEN'S COMPENSATION ACT.

At the invitation of President Murrow, Mr. Charles Kerr, representing the Independence district in the Kansas Legislature, presented a review of the provisions of the new Kansas workmen's compensation act, which, as chairman of the House committee, he introduced and advocated to its final passage.

In the compensation of injured workmen the purpose of this law is to substitute for the present system of expensive suits and litigation, in which the injured party receives actually only about one-sixth of the amount paid by the employer in settlement of the claim, a simple method of arriving at and paying to the injured workman a fair compensation for his loss of earning power. The lawyers and courts, with their expensive fees, retainers and costs, are thus eliminated from the equation, which recognizes accidents as simply a result of carrying on the business and assumes that the workman should be repaid for the loss of earning power he has suffered. The new Kansas law, in case of a workman's death, grants three years' wages—amounting to not more than $3,600 or less than $1,200—to his de-

pendents, the payment being limited, however, to $750 if the dependents live outside this country. If the injured man is without dependents the employer is liable only for burial and medical expenses, not exceeding $100. Where total incapacity for work results the injured employee receives 50 per cent of his former earnings, and in case of partial disability from 35 per cent to 50 per cent of his former wages, this compensation award continuing during disability, but not exceeding ten years. As written, an employer may express his desire to come under the compensation law or not as he elects, but in the event he does so fail to elect, and he is sued by an injured employee, he is denied the usual common-law pleas of fellow-servant act, contributory negligence or assumed risk. The law applies only, of course, to injuries received in the employee's regular line of work and is effective only in employments using fifteen men or more, but smaller employers may come under the law upon making application.

Owing to lack of space, the remainder of the report of the convention is held over for the following issue.

The 1911 Meeting of the British Association for the Advancement of Science.

Following are abstracts of papers presented at the Portsmouth meeting of the British Association for the Advancement of Science, a general account of which meeting was printed last week. Further abstracts will appear in the following issue.

In Section G the first paper was by Mr. H. A. Mavor upon "Electrical Drives for Screw Propellers."

On account of the great difference in the economical speeds of propeller shafts and prime movers it is desirable to place speed-reducing mechanisms between the shafts and the engines. For this purpose there are available mechanical gearing by toothed wheels, hydraulic transmission and electric transmission. In cost, weight and efficiency the electric transmission compares favorably with either of the two competing methods; in other important qualifications it is unrivaled. For example, it provides a ready means of reversing the direction of rotation of the propeller without changing the direction of rotation of the main generator; it provides means for changing the speed ratio so as to permit economical operation at all speeds; it provides means for operating at each instant only the exact number of engines required by the load.

Mr. Mavor described the equipments of the steam-turbine ship *Freida*, designed to carry 5000 tons; a United States navy steam-turbine collier designed to carry 12,500 tons at 14 knots; a 245-ft. oil-engine canal barge and the experimental ship *Electric Arc*, equipped with a 45-hp gas engine. In all cases three-phase motors are used.

Prof. W. E. Dalby opened the discussion by asking for figures of mechanical efficiency of Mr. Mavor's system at full, half and quarter load. He also asked for some dimensions of the motors attached to the propeller shaft, as he anticipated considerable flywheel action, which would give rise to some interesting problems with regard to the strength and oscillation of the shaft. Prof. J. E. Petavel pointed out that the system practically involves three sets of propelling machinery, namely, the turbine or engine, the generator and the motor. Each of these is liable to individual defects and introduces greater liability to breakdown.

Prof. G. W. O. Howe asked for a few particulars of the windings of the motor and for an explanation of the method of shutting down one of the generators without touching any of the switches and without bad effects. He said that ordinarily when one generator is shut down while the other two are running energy is pumped back from the motor and tends to drive the engine. He disagreed with Professor Petavel's view that the three links in Mr. Mavor's system of transmission are a disadvantage, as squirrel-cage motors and alternating-current generators can be made so reliable that they will not introduce any weakening in the chain.

Dr. J. M. Morrow asked for what type of vessel the author would suggest his system to be most suitable. There are the low-speed cargo boat, the high-speed liner and the warship. In the former the electric drive has to compete with mechanical drive; in the high-speed liner electricity has yet to make out a case, while in the case of warships the question of economy at low speeds is the determining factor. The United States Navy has discarded the turbine for the reciprocating engine and this type of vessel may be the more suitable field for electric drive.

Mr. C. T. Dyer asked, in reference to the vessel in which three oil engines are used for driving the dynamo, if the efficiency is as good as with one engine. Mr. C. E. Handy also asked for information on this point. He expressed the belief that three small engines would not have as high an over-all efficiency as one large engine.

Sir William White said he must correct Dr. Morrow as to the action of the United States Navy in preferring reciprocating engines. The navy had merely installed this type in one vessel built by a particular firm owing to the very satisfactory results obtained in a previous vessel built in the same yard.

President Biles asked as to the effect upon the motors if they were "drowned out" in any way.

Mr. B. P. Haigh said he knew of a case in which motors of the type mentioned by the author had been flooded with salt water and continued in operation perfectly well. The voltage was not so high as that used by Mr. Mavor, but the effect of flooding was not such as to cause any great anxiety provided the motor was not allowed to remain in that condition too long.

Mr. Mavor in his reply said he was able to use voltage varying from 600 to 2000, the latter value being used with the object of keeping down the size of the cables in the newer designs. Where there is any essential reason for keeping the voltage down it can easily be done. The estimated mechanical efficiency of the boats mentioned as about to be built is 90 per cent. It is possible to increase it to 96 per cent, but in adopting a motor which would give this value its properties would not be quite so favorable for the purpose in view; in order to push up the efficiency the clearance between the moving and stationary parts must be reduced to very small limits. The question is whether one can afford to undergo the loss of 6 per cent. The answer is that in the case of the *Freida* the coal consumption would be reduced from 40 tons to 30 tons per day. The diameter of the motor is about 15 ft., which has been found to be large enough to deal with most cases. Concerning strains, he said that in the *Electric Arc* the motor weighs about 1000 lb. in the rotating part and there is no indication of strain or disturbance to the propeller shaft or bearings. In the sea the motor runs much more steadily than the engine. The electric system does not involve three sets of machinery, but one, with two rotating parts. The rotor of the turbine and the generator are rigidly coupled together and form one rotating part. The motor is rigidly fixed to the propeller shaft and it is simpler in construction than a cartwheel. All the other parts are stationary and correspond with the stationary parts of a reciprocating plant. The moving parts in both systems are precisely the same in number. To the electrical engineer the system is not a complicated one. All change in the connections is made when no current is flowing and there is no danger.

The author said that he had had an opportunity of making a precise comparison with a mechanically geared ship and there is no doubt that mechanical driving is a very serious competitor, indeed, in respect of mere transmission, but he was much pleased to be able to say that the weight, price and efficiency of the electric system are about the same, and in the *Freida* the steam consumption with the

electric drive will be 25 per cent less. There is no more danger of breakdown with the electric driving of ships than there is with other forms of applying electric power. In the design of the motor the whole question is to make the windings mutually non-inductive. The use of three engines instead of one has the advantage that one can be shut down when high speeds are not required. The boat of bulk freight already mentioned has to go at slow speed in the locks and canals, but is to be run at full speed in the lakes. Another point is that three low-power Diesel engines are lighter than one high-power engine. With regard to short-circuiting, he said that he had astonished the representatives of the Admiralty by being able to throw the motor right over from full speed ahead to full speed astern without anything happening except that the boat went astern as desired. In this respect the squirrel-cage motor is a distinct advantage. As to other possibilities of short-circuit, he had put a similar motor in a tank of water for a whole day and run it without trouble, although there was danger of damage to the insulation if the test were maintained for too long a period. Again, even if the cable on the boat were to be connected to the body of the ship the generator would give out two and one-quarter times its normal power at low voltage and the turbine would continue to run, but there would be no danger to anyone in the boat. Mr. Mavor also mentioned that an order for one of the colliers described had been placed by the United States Navy and that Admiral Cohn, of the United States Navy, has expressed his intention of placing an order for a second one. He remarked upon the greater interest which is being taken in this matter by the United States Navy compared with the British Admiralty.

Mr. B. P. Haigh then read a paper on electrical steering in which he stated that electrical steering offers considerable advantages for steamers as well as for vessels propelled by internal-combustion engines, for the improved economy corresponds to a saving of weight in boilers and fuel. Difficulty has been experienced in obtaining a reliable system of control, capable of dealing with the power necessary to put the helm hard over in emergency in the shortest possible time and possessing sufficient sensitiveness to enable an accurate course to be kept by moving the rudder promptly in small angles. The steering motor may be started and stopped for every motion of the rudder, but it is preferably kept running continuously, mechanical control being introduced either in the form of hydraulic transmission or in the form of magnetic clutches as developed by the writer of this paper. In the latter type of gear two magnetic clutches are employed, these being fitted at opposite ends of the motor; and, as no gearing is kept continuously in motion, the wear and tear, as well as the current required, are reduced to a minimum. The clutches prevent the shock of the sea being transmitted to the electrical system and, as they have considerable flywheel effect, the current taken by the motor does not fluctuate widely under normal conditions and the steering gear may therefore be supplied with energy from the ship's lighting generator.

Sir William White opened the discussion, expressing a strong prejudice in favor of electrical steering. A difficulty with regard to it, he said is the human element. On one yacht with such a gear, which he himself had designed, there was nearly a collision due to the nervousness of the operator, because he kept moving the gear without giving the hunting gear time to do its work. With all electrical systems it is essential to install a helm indicator quite independently of the gear, so that the man in the steering position can see where the helm is. Prof. W. E. Dalby, referring to the author's system in which magnetic clutches are made use of, asked as to the coefficient of friction between the fiber and the steel and what would be the safe limiting pressure to work at in order to make sure of durability of the fiber—that is, the pressure per square inch between the fiber and the armature under normal conditions.

The author replied that at first the fiber gave a little trouble, being very hygroscopic. It is now boiled in linseed oil, which fills up all the pores, and no water gets in. He usually relies upon a coefficient of one-sixth.

A long mathematical paper was given by Mr. T. F. Wall upon the single-phase repulsion motor. The author developed the circular current diagram of the machine and reported the results of tests made upon a 6-hp unit.

Prof. Ernest Wilson, in a paper entitled "The Electrical Conductivity of Light Aluminum Alloys," described tests recently completed showing that alloying commercial aluminum alone with copper to the extent of 2.6 per cent is not to be recommended. An alloy known as "duralumin" has been tested and a report is made thereon. Its specific resistance is 5.35×10^{-6} ohms at 15 deg. C. as against 2.76×10^{-6} for pure commercial aluminum.

On Monday Section G was mainly concerned with a discussion on mechanical flight, but subsequently found time for a lucid exposition of wireless telegraphy, with special reference to recent developments by Prof. G. W. O. Howe. The author had installed an equipment in the lecture-room and received time signals and weather reports from the large station on the Eiffel Tower in Paris, and also from Norddeich, in North Germany. These signals, however, were not received without interference from other stations.

Professor Howe stated that the total number of ships of the mercantile marine fitted with Marconi apparatus at the end of 1907—that is, after seven years of development—was 140; at the end of 1908 the number was 220; at the end of 1909 it was 330; while at the close of last year it had risen to 510. In addition to the mercantile marine, practically every ship in the British navy has been fitted with the Marconi apparatus. The Telefunken Company, of Berlin, carried out 106 installations last year, bringing the total number of stations using its apparatus up to nearly 1000. About 500 of these are warships, principally German and Russian, while 100 are portable military sets. Excluding German boats, only thirteen ships of the mercantile marine are fitted with Telefunken apparatus. Attention was called to the troubles from interference between stations working simultaneously, which promise to become of the gravest importance in the immediate future. Interference is being minimized by sending out well-sustained trains of waves of one definite frequency and by using a high musical pitch easily distinguished from the crackling noises caused by atmospheric disturbances, and also from other stations having notes of different pitch. The detectors now employed in conjunction with the telephone receiver are not only more sensitive than the filings coherer operating a Morse inker, but they enable the operator to discriminate between signals being sent to him and the various disturbances picked up by the aerial. To produce a musical note of high pitch it is necessary to make the sparks follow one another with great regularity and rapidity, say, 1000 per second. The simplest plan is to use a 500-cycle alternator and adjust the voltage until the gap breaks down once every half cycle. Practically all the radiotelegraphic apparatus working commercially or being installed at the present time is based on the principles outlined; with the exception of the spark-gap and the detector employed the differences are non-essential.

This paper was followed by a series of lantern slides, which were exhibited by Capt. H. Riall Sankey and which depicted Marconi's portable field sets for cavalry and infantry use. These showed in a very interesting manner the way in which the frame of the saddle in the cavalry set is used as a stand, the generator and oil engine resting on brackets, one on either side, the necessary connection being made by a flexible shaft. In the cavalry sets four pack horses are used. These sets, which are of 0.4-kw rating, have a range of 20 miles over mountainous country, or 50 miles over normal country. The aerial pole is 60 ft. in

height, and the whole station, it is said, can be unpacked and erected in nine minutes and dismantled and packed again in six minutes. The infantry sets are of 1.5-kw rating, and these have a range of 200 miles. In all of these portable sets a valve receiver is used. During a conversational discussion upon Professor Howe's paper and Captain Sankey's slides it was stated that both at Clifden and Glace Bay a valve receiver is used, with an air blast to quench the spark. It was also mentioned that the Marconi transatlantic station is working with a wave-length of 20,000 ft. The cavalry set illustrated works with a wave-length of 300 m (990 ft.).

Owing to lack of space the remainder of the report of the meeting is held over for the following issue.

Public Service Commission News.

WISCONSIN COMMISSION.

The Wisconsin Commission recently held a hearing on the question of physical connection between telephone lines, this being the first hearing since the law providing for such connection was passed by the Legislature last winter. A petition was presented by the Linzy Brook Telephone Company asking for connection with the Cecil-Green Valley Telephone Company. A similar case involving the La Crosse Telephone Company and the toll lines of the Wisconsin Telephone Company was postponed to the November calendar.

A number of hearings involving the refusal of certain utilities to comply with the orders of the commission have been postponed a month upon request of the utilities involved and with the sanction of the engineering staff. This was done for the purpose of allowing the utilities a little extra time in which to complete the alterations and improvements ordered by the commission.

The Oshkosh Gas Company has filed with the commission a revised and reduced schedule of rates for gas. The old rates were $1 net for gas used as fuel, and ranged from $1.50 net per 1000 cu. ft. for the first 10,000 cu. ft. to $1.20 net for all gas used in excess of 50,000 cu. ft. per month for gas used for illuminating purposes. Under the revised schedule all gas is to be registered by one meter and paid for at the following rates: For the first 15,000 cu. ft. per month, $1 net; for the next 35,000 cu. ft., 90 cents; for all over 50,000 cu. ft., 75 cents net. The minimum bill is to range from 50 cents per month for a three-light meter to $4 per month for a 200-light meter.

The case of C. R. Martin vs. the Southern Wisconsin Railway Company was argued before the commission on Monday. The petition related to the rule recently put into effect by the traction company prohibiting the carrying of certain designated articles on the company's cars. The immediate matter in controversy was a section of the rule prohibiting the carrying of baby carriages unless inclosed in a paper or cloth bag. The testimony tended to show that this section was prohibitive in its nature; that it was unreasonable and unnecessary. The company defended the rule on the ground that it was necessary in order to maintain the car schedule and that the presence of baby carriages on cars, especially in rainy weather, worked an inconvenience to the traveling public. Under the same rule the company prohibits a working man carrying his tools with him. On account of the peculiar shape of the city of Madison this rule works considerable hardship. The commission has taken the case under advisement.

NEW JERSEY COMMISSION.

At a hearing before the Board of Public Utility Commissioners of New Jersey in Newark on Sept. 27 in connection with an inquiry into the electric and gas rates of the Public Service Corporation of New Jersey, Thomas N. McCarter, president of the corporation, made an extended address. He described the organization of the corporation and the capitalization of the underlying gas and electric companies. He argued that the decision of the United States Supreme Court in the Consolidated Gas Company case settled the legal validity of underlying securities of the Public Service Corporation because conditions in the two instances were alike. Mr. McCarter contended that no less than 8 per cent should be allowed on a fair valuation of the property devoted to the public use. The state of turmoil involving a long investigation would be disastrous to the business of the company and its efforts to raise the additional new capital required. He proposed that a schedule of rates should be fixed by the board effective for a period of five years from Jan. 1, 1912, on a basis that would recognize the obligations of the Public Service gas and electric companies as to their respective underlying securities, and enable these companies to pay annually a dividend of 8 per cent on their actual capital as it will exist from year to year after the deduction of proper reserves for maintenance and the provision of a moderate fund for such capital expenditures as business prudence demands should not be capitalized, but must be made as an inducement to new capital. The proposed schedule of rates for the Public Service Electric Company is the same schedule of discounts from the base rate which was placed in effect recently by the New York Edison Company. The present Public Service rate steps down one cent for every 500 kw-hour of monthly consumption for the first five steps; the New York rate steps down 1 cent for every 250 kw-hour of monthly consumption for the first four steps. In the fourth year of the period, or on Jan. 1, 1915, the base rate is further reduced from 10 cents to 9 cents, thus combining the first two steps of the theretofore existing schedule.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has authorized the Empire Gas & Electric Company to issue $51,000 in 5 per cent joint first and refunding thirty-year gold bonds. The bonds are to be sold at not less than 85 and the proceeds used in extension and improvements to the company's property in Auburn and other proper capital expenses of the company.

The commission has received a preamble and resolution from the Common Council of the city of Watervliet reciting that that city, with a population of 15,000, has no telegraph office; that the Western Union Telegraph Company has received a valuable franchise from the community permitting the erection of poles and wires for the conduct of its business and for many years did maintain and conduct an office in that community, but for some reason discontinued the maintenance of such office. The commission is asked to compel the Western Union Telegraph Company to establish and maintain a centrally located office for the sending and receiving of messages in the city of Watervliet. The complaint has been served upon the company and an answer required within twenty days.

The commission has received a complaint from residents of Ulster Park, Ulster County, and members of Ulster Grange No. 969, requesting the issuance of an order directing the New York Telephone Company to render direct service from Ulster Park with the Kingston exchange without toll charge. At the present time the telephone company has established a boundary between Kingston and Esopus with the exchange centering at Esopus and including Ulster Park and vicinity. The subscribers from this exchange have to pay a toll rate for Kingston calls or are charged for mileage for direct communication with the Kingston exchange. The complainants state that even after paying this mileage charge they are still required to pay toll to talk with subscribers on the Esopus exchange. It is claimed that the boundary as determined

by the telephone company is arbitrary and made without due respect to the needs and convenience of residents of this section. This complaint has been served upon the company and an answer will be filed within twenty days.

CURRENT NEWS AND NOTES.

The "Tungsten" Cigar.—In their search for striking names for their products the cigar manufacturers have now fastened upon the name "Tungsten." The Tungsten cigar is already advertised for sale in the West as the "bright white light of cigardom."

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Vacuum Cleaners in Schools.—The Russell Sage Foundation, a philanthropic institution, in an investigation of the subject found that dust in schools is a prolific source of contagious diseases and as a result has recommended that vacuum cleaners be used in school buildings.

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A Correction.—In the letter to the editor from Mr. W. A. Del Mar on "Values and Depreciation," which apeared on page 757 of the issue of Sept. 23, the words "satisfying wants" in the quotations from Mr. C. H. Chase, at the end of the twenty-second line of the letter, should read "the relations."

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Bureau of Standards Vacancies.—The United States Civil Service Commission will hold examinations Oct. 25-26 to secure eligibles to fill places in the Bureau of Standards as they occur. Details of the examination are given in Circular 803 of the commission, of which a copy may be obtained by addressing the United States Civil Service Commission, Washington, D. C.

* * *

Electrical Turnstiles.—A system of electric turnstiles has been installed at the Indiana State Fair Grounds, Indianapolis, which includes a tabulating device in the office of the superintendent of admissions, whereby each admission is recorded as the person enters any of several gates some distance apart. The electric tabulating machine contains a separate tabulating section for each turnstile and enables the management to ascertain the exact attendance any time during the day. Each visitor deposits a half-dollar in a coin slot, which unlocks the turnstile to admit him and at the same time indicates his admission on the tabulating apparatus in the superintendent's office.

* * *

Electrical Moth Exterminator.—Electric light and emf are the two agents employed in a coddling moth exterminator which is said to have been employed successfully by Messrs. W. M. Frost and J. C. Lawrence in an apple orchard at Opportunity, Wash. The apparatus consists of a storage battery to furnish energy to 6-cp incandescent lamps, which are netted with fine steel wires maintained at a difference of potential between adjacent wires. Attracted by the bright light in the tree, to which the globe is strung by a covered wire, the moth flies against the net work, completes the circuit and is instantly killed. It is claimed that the electrical device is much cheaper to install and operate than spraying apparatus.

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Denver Electric Show.—At the midweek luncheon of the Colorado Electric Club on Sept. 21 reports were made by the various committees having in charge the Electric Show to be held Oct. 14-21 in the Denver Auditorium. Among new features arrangements have been compiled for an illuminated parade of electrically decorated electric vehicles. Over 500 pleasure and 100 commercial machines will be in line and the parade will extend over sixty blocks. All traffic will be suspended along the line of march and no gasoline machines will be allowed on those streets nor within the parking limits at the Auditorium. This is expected to prove not only a successful feature, but one also of benefit in advancing the interests of the electric vehicle in Denver and neighboring cities.

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Bathing-Beach Alarm System.—The beach city of Venice, Cal., has completed and placed in service an alarm system for life-saving, fire and police service. Operating from posts along the beach, fifteen alarm boxes connect with the Ocean Front Bath-house for summoning the life-saving crew. The annunciator at this station has numbered buttons which become lighted when the corresponding alarm box is operated; in addition a bell rings until the button is pressed in response. For police service the telephones and red lights are provided, while the usual equipment is employed for the fire department. To insure protection against moisture and other damage the wires are carried in cable, a total of about 76 miles of conductor being necessary for the installation. All metal fixtures exposed to the salt air are galvanized to prevent corrosion. The system, with its three arms of report, cost approximately $3,000, and, based upon the cost of repairs for the former service, it is expected to pay for itself within a short period.

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Hydroelectric Power.—Bulletin No. 3, just issued by the Mississippi River Power Company, which is building the great water-power development opposite Keokuk, Ia., declares that as the result of the completion of the preliminary work and the rapid attack on permanent construction already made during the past six months, delivery of hydroelectric energy from the Mississippi is now thoroughly assured by the date originally set, July 1, 1913. A round million dollars has been expended in the construction plant alone, and on account of the heavy expenses involved between the beginning of construction and the delivery of energy, all possible speed is being made in building the dam and power house. Most of the wheel-pit excavation is now finished, and concrete has been placed for some of the huge draft tubes. The rate of placing concrete on the dam has increased with experience, and more than one-fourth of the arches and piers are already in place. The new navigation lock, a part of the dam project, will be 110 ft. wide and 400 ft. long, with a 40-ft. lift.

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Rewards of Literature.—A technical writer in Chicago who has contributed to a number of American papers and magazines determined to endeavor to find an outlet for part of his literary output abroad. Accordingly, he sent an article, written in the language of the country and accompanied by a photograph, to a technical journal quite well known and published in a Continental capital. In due course he received a courteous letter from the editor saying that the article had been received and accepted and would be paid for on publication. Judging from his experience with American publications the author felt reasonably sure that he would receive a respectable remittance for his work. He was rather surprised, therefore, when he came to find that it consisted of foreign postage stamps of the value of 72 cents in the land of issue. As the author had paid 15 cents in postage and had no market for the foreign stamps he did not consider the transaction a very profitable one. The sequel to this true story is that the author, who saw the humorous aspect of the situation, wrote an account of it for an American literary periodical and received for the second "story" many times as much as the original compensation, even if the latter had been in real money.

ST. LOUIS LEAGUE OF ELECTRICAL INTERESTS.—The noonday luncheon of the St. Louis League of Electrical Interests, held at the City Club, St. Louis, Tuesday, Sept. 26, was addressed by Mr. Ell. C. Bennett on the subject of "Electrical Publicity."

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UNION ELECTRIC N. E. L. A. BRANCH, ST. LOUIS.—The next meeting of the Union Electric Light & Power Company (St. Louis) Section of the National Electric Light Association will be held Friday evening, Oct. 27, when Mr. S. N. Clarkson, of the company's commercial engineering department, will talk on "A Trip Through Some European Power Stations."

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INDIVIDUAL EFFICIENCY.—Mr. H. N. Tolles, of the Sheldon School of Salesmanship, gave an address on "Individual Efficiency" before the Electric Club of Chicago at the midday meeting of Sept. 20. Mr. Tolles discussed the psychology of salesmanship and told of the "success formula." He said that according to the science of salesmanship the success of every man depends on his "area." This word "area" is made up of the initials of the words "ability," "reliability," "endurance" and "action," and all these qualities should be developed in about equal degree to make a successful four-square man.

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TELEPHONE SERVICE ON THE ISTHMUS OF PANAMA.—A contract has been entered into between the Panama Railroad Company and the Isthmian Telephone Company, a local corporation organized for the purpose of conducting a general telephone business on the Isthmus of Panama, by which the railroad company transfers its commercial toll-line business originating at Colon or Panama to the telephone company. The telephone company will at once establish its toll-line service, using the railroad company's circuits out of Panama and Colon. It has an exchange in operation in Colon and has also obtained the concession for the establishment of a local exchange in the city of Panama. The contract does not include the whole Canal Zone in its scope, and the present arrangement of charging $7.50 a month for commercial service will be continued at all intermediate points.

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ELECTRIC TOWAGE FOR PANAMA CANAL.—The Isthmian Canal Commission, Washington, D. C., has advertised for proposals for furnishing one electric towing locomotive, complete, for the Gatun Locks, and thirty-nine electric towing locomotives for towing ships through the locks of the Panama Canal. Four locomotives will be required to tow a vessel of moderate size—two ahead, one on either wall, towing, and two behind, trailing, to keep the vessel in the middle of the lock. The towing speed is 2 miles per hour. The electrical equipment of each locomotive is to consist of two traction motors and control. There are also to be a motor and controllers for operating a windlass for hauling in or paying out the tow-line under load, and a high-speed, motor-driven attachment for coiling the tow-line when out of service. The motors are to be three-phase, 25-cycle, 220-volt induction motors of the railway or mill type, totally inclosed and moisture-proof.

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SCIENCE DEFINED.—Mr. R. T. Crane, the Chicago multi-millionaire who at intervals breaks loose in denunciation of higher education—apparently considering it a presumption for schools to teach men more than he himself has been able to acquire in his "self-made" career—has recently returned to his attacks on technical education. Just previously he fired a volley at higher institutions of learning in general, charging, as the result of reports of detectives engaged by him for the espionage of students, that our larger universities are seats of gross immorality and debauchery. A ludicrous incident in this connection was a public overhauling of the author of the attack by a grandson, a student at Harvard—for it appears that opposition to higher education does not extend to prohibition of its acquirement by members of the critic's own family. In fact, this opposition appears to be largely that of an employer who resents the entry of the schools as a factor in the industrial field. In the diatribe against technical education, after stating that all departments of "higher schooling" are founded on "error, deception and ignorance," a definition of science is given, in connection with the remark that the masses "imagine that since science in the past has played an important part in the progress of civilization, the same must be true to-day," which assumption is flatly denied. "Let me," he says, "state just what I mean by science. The dictionary definition is very long and unsatisfactory, and, in my opinion, inconsistent with the general understanding of the word. Science means the doing of things in a more or less highly intellectual way by taking advantage of natural laws and principles. The wheel in a wheelbarrow; the lever; the block and tackle; braces and trussing; the hammer, the axe; the building of cofferdams; the building and making of caissons, etc., I consider to be scientific, and I believe the general public will accept this definition. While scientific principles are very numerous, yet many of them are also exceedingly simple; in fact, most of them are so considered by good mechanics."

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UNUSUAL ELECTRICAL ACCIDENT.—According to the Los Angeles newspapers, Martha Elizabeth Bloom, a four-year-old child, was the victim of an unusual electrical accident in Pasadena, Cal., a short time ago. Martha was playing on South Fair Oaks Avenue near her home and while she was seated on a fire plug it is said that a guy wire of the Pacific Light & Power Corporation broke and fell on the hydrant. Current escaping over this broken wire caused a short-circuit at the fire plug resulting in a burst of flame. The child's clothes caught fire and she was badly burned about the legs before the flames were extinguished. The company, it is said, volunteered to compromise any claim on behalf of the child for $1,500, and as the matter had been brought into court the judge allowed the child's guardian to accept this compensation.

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CONDITIONS IN THE ORIENT.—The regular weekly meetings of the Electric Club of Chicago were resumed Wednesday noon, Sept. 13, at the usual place. Mr. A. D. Curtis, president of the National X-Ray Reflector Company, who recently made a trip to Japan, China and the Philippines, gave an interesting and entertaining account of his trip and some of the conclusions which he reached as to the probable futures of those countries. The talk covered political, social and economic conditions in those countries, as well as electrical development, but he seemed especially impressed with evidences of American activity in Manila. He complimented the street-railway service in that city and observed that the native Filipinos are excellent mechanics when properly trained and well suited to operation of electric plants. Except in some of the foreign centers China is practically without electrical development. Japan, he said, is actively preparing to get the trade of China which is sure to come with the foreign innovations in that country. In the securing of this trade Japan would be America's most active competitor and by reason of its proximity would have a decided advantage. It is not a question of America securing Japanese trade, but of whether Japan or America will get the Chinese trade. The speaker described China's political conditions as very unsettled, primarily due to the fact that the rulers are not of the genuine Chinese nationality and that the masses feel that they are being oppressed and imposed upon by foreign rulers.

Lightning Damages Plant Chimney.—The municipal water and electric-light plant at Winfield, Kan., suffered a lightning stroke to its tall chimney Sept. 18, the engineer and two firemen in the boiler-room being knocked down by the shock. Mr. Harry V. Forest is plant manager for the Winfield Municipal Commission.

* * *

Annual Meeting of Sons of Jove.—The ninth annual meeting of the Order of Rejuvenated Sons of Jove will be held at the Denver Auditorium in Denver, Col., on Oct. 16, 17 and 18, during the Denver Electrical Show. A number of important subjects will be discussed, including the matter of publishing advertising in the *Jovian Bulletin*.

* * *

Wired-House Ratio in Manhattan, Kan.—The town of Manhattan, Kan., probably stands near the head of the list in its ratio of central-station customers to population. With barely 6000 people in town, the Manhattan Ice, Light & Power Company has 1200 electric-lighting and power meters in service, according to Mr. B. F. Eyer, vice-president of the company.

* * *

Tests of Meters.—Tests of customers' wattmeters reported by companies to the New York Public Service Commission, Second District, show that of 6506 tests in July, 1911, 465, or 7.15 per cent, were fast; 4926, or 75.71 per cent, were accurate, and 1115, or 17.14 per cent, were slow. Of a total of 238 companies thirty-six did not report, and of those which made reports 115 made no tests.

* * *

Advertising an Investment or an Expense?—An article by Elijah W. Sells, published in the September issue of the *Journal of Accountancy*, discusses the subject, "Should Advertising Expenditures Be Charged as an Investment or as an Expense?" The article was presented originally as an address before the Associated Advertising Clubs of America. It discusses the advantages of publicity regarding financial affairs and also the extent to which advertising for the purpose of developing good-will may be held properly to be an investment.

* * *

New York Y. M. C. A. Lectures on Electricity.—Illustrated evening lectures on electricity will be given under the auspices of the Department of Education of New York City during October, November and December in a number of public schools and branch public libraries, six in all. Prof. W. Wallace Ker, of the Hebrew Technical Institute, will give a course both in Manhattan and Brooklyn on the principles and practice of electrical engineering. The other lectures will be on elementary electrical science, by Messrs. J. Newton Gray, Frederick W. Huntington and Charles L. Harrington and Prof. John S. McKay.

* * *

Electricity in Farming.—An experiment with electric power for agricultural purposes was made on Sept. 18 at the farm of John Prouse, near Ingersoll, in the county of Oxford, Ontario, service being taken from a line of the Canadian Hydroelectric Commission. The demonstration consisted of filling a silo, for which work Mr. Prouse had installed a special equipment. The test was pronounced eminently satisfactory in every particular and emphasized the value of Niagara power to the farmer. Hon. Adam Beck, chairman of the Hydroelectric Commission, the Ingersoll light and power commissioners and many representative farmers were present.

* * *

Central Station Renders Medical Service.—Lewis, Ia., is lighted by a 25-kw gasoline-engine-driven central station, which was described in the *Electrical World* of April 20, 1911. A few days ago one of the members of the little community which gets its electrical supply from this tiny power plant was badly injured, and when taken to the doctor's office the physician declared he must have electric power immediately to operate one of his instruments. Lewis has at present no twenty-four-hour service, but the electric-light man was quickly reached on the telephone and the situation explained to him. In a minute he had run to the plant and in two more cranked up the little engine. In four minutes the doctor had his electricity and the man's life was saved.

* * *

Electricity in the Transvaal of Boer War Times.—Some incidents of former electrical conditions in the Transvaal country of South Africa were recounted by Mr. Ivor Thomas, formerly with the Barnato company's central station at Johannesburg, and now of the Kansas Gas & Electric Company, Wichita, Kan., in a talk on "Accounting" before the Kansas electrical convention, Sept. 21. Residence customers in Johannesburg paid 33 cents per kw-hour for their electricity and in some of the suburbs service was interrupted after 12 midnight. No accounts were rendered customers, but bills were known to be due on the tenth of the month, and if not paid by the fifteenth at the company's office service was discontinued without warning. New customers were required to pay $10 deposit and those who objected were told they could do without light if they wished. In reply to a member of the Raadzaal who proposed converting the local horse-car line to electric trolley, President Kruger retorted: "This is an agricultural country and grows oats to feed horses. If we have an electric line we shall have no horses to feed, so the farmers will lose the sale of forage. We will go on with the same street cars as before and if these Englishmen who want electric cars are not careful I will get a law passed to take away their 'verdommt' telephones!"

* * *

Changes in Purdue Electrical Faculty.—Prof. L. D. Rowell, formerly assistant professor of electrical engineering at the Case School of Applied Science, has been secured to take charge of the electrical laboratory of Purdue University, Lafayette, Ind. Professor Rowell is a 1901 graduate of the University of Wisconsin, where he held a graduate scholarship the following year. During the three succeeding years he was chief engineer of the Arnold Magnetic Clutch Company and for four years following was in charge of experimental work with the Cutler-Hammer Manufacturing Company. During the last two years he has held the above-mentioned position at Case School of Applied Science. Aside from the direction of the electrical laboratory, Professor Rowell will have charge of the first semester course in electrical engineering, which embraces the theory of electrical transmission and distribution systems. Prof. A. D. DuBois, who was graduated from the University of Illinois in 1899 and for the last three years has been instructor at Cornell University, will have immediate charge of the junior electrical laboratory under the general direction of Professor Rowell and will also give the electric course in electric-railway engineering for seniors in the electrical school. Prof. DuBois since graduation from the University of Illinois has been employed with the Electric Storage Battery Company, the Wabash Railroad and the Western Electric Company, and for the year previous to his instructional work at Cornell was in charge of important electric-railway developments of the Illinois Traction Company at Decatur, Ill. Mr. D. L. Curtner, who graduated from the Purdue school of electrical engineering last June and who has been engaged in transformer design for some years with the Hornberger Transformer Company, of Lafayette, will assist in the design department and in the electrical laboratory.

ELECTRIC ENERGY FROM COAL FOR IRRIGATION FARMING IN COLORADO.

By C. H. WILLIAMS.

COLORADO is ordinarily looked upon as a mining State by those unacquainted with its real resources. A few years ago the mining industry was the most important factor, but this condition has been changed and agricultural interests have placed the mining industries in the background. To-day the value of the agricultural products is many times that of mining, not because of the falling off of the mining industry, but because of the rapid advancement made in agriculture; and still this work is in its infancy. The States of Colorado and Wyoming lie in an arid and semi-arid zone, the rainfall being insufficient to mature the crops, and hence irrigation must be carried on to make crop-raising pay.

WATER REQUIRED FOR CROPS.

To grow a crop and bring it to maturity, 22 in. average depth of water seems to be the minimum which will produce results, and this must be supplied at such time as the growing plants require. Each crop requires water at a time peculiar to its needs. Winter and spring wheat, barley, oats and other grains require as a maximum 12 in. of water during the months of June and July, during the period of the filling of the heads of grain. Potatoes and sugar beets require a maximum of 12 in. during the months of August and September, during which time these crops are filling most rapidly below the surface of the ground. Alfalfa requires a large amount of water immediately following the cutting of each crop. All of these crops require irrigation at other periods, but these constitute the maximum conditions.

LOSSES IN IRRIGATION WORK.

A large amount of the water run upon the land is lost through seepage and evaporation. The evaporation from an open reservoir in this territory varies from 5 to 8 ft. of vertical depth per year, when water is available for evaporation all the time, and this amount is much increased where moisture is available for evaporation in an open field, because on newly cultivated land the exposed surface from which evaporation can take place is very large in comparison to the plain surface of a lake or reservoir.

For many reasons the efficiency of irrigation work is less in Colorado than in some older districts, particularly California. In California the losses are reduced to as small a point as possible. The waters are largely carried in closed pipes or conduits, and where open ditches are made use of these ditches have been lined or puddled so that seepage is at a minimum. The losses from evaporation are less in California than in the arid countries because of lesser altitude, lesser differential temperature and higher barometrical pressure. The value of the water in the old irrigated countries is more thoroughly established and greater care is exercised in applying water to the ground.

As an example: Colorado irrigators largely carry on their work of irrigation in the day time and under conditions of brightest sun and heavy winds. With these conditions, double the amount of water must be supplied to furnish the actual water taken by the plants as would be required if application were made at night time when winds are low and when the differential temperature of the water and ground and the overhanging air is least.

With some crops irrigation in the heat of the day is actually injurious to the growth of the plants. The water coming in direct contact with more delicate plants gives them a shock from chilling and frequently retards their growth. This is not true, however, with any of the crops as grown in northern Colorado.

RAINFALL.

Accurate records of the rainfall kept by the government for seventeen years past show that in northern Colorado east of the Rocky Mountains the precipitation varies in localities from 12.27 in. at the Greeley observation station, which is 4639 ft. in elevation, to 17.66 in. in Larimer County at an elevation of 7750 ft.

The distribution of the rainfall throughout the year is a factor as important as the amount which falls, and Nature has provided so that the rainfall goes as far as possible to help the plants in supplying 60 per cent of all the rainfall of the year during the growing period, which consists of the five months from April 30 to Oct. 1.

LAND VALUES.

If rainfall alone has been depended on, the only value which could be attached to the vast areas of fertile soil would be the value as a grazing range and lands would

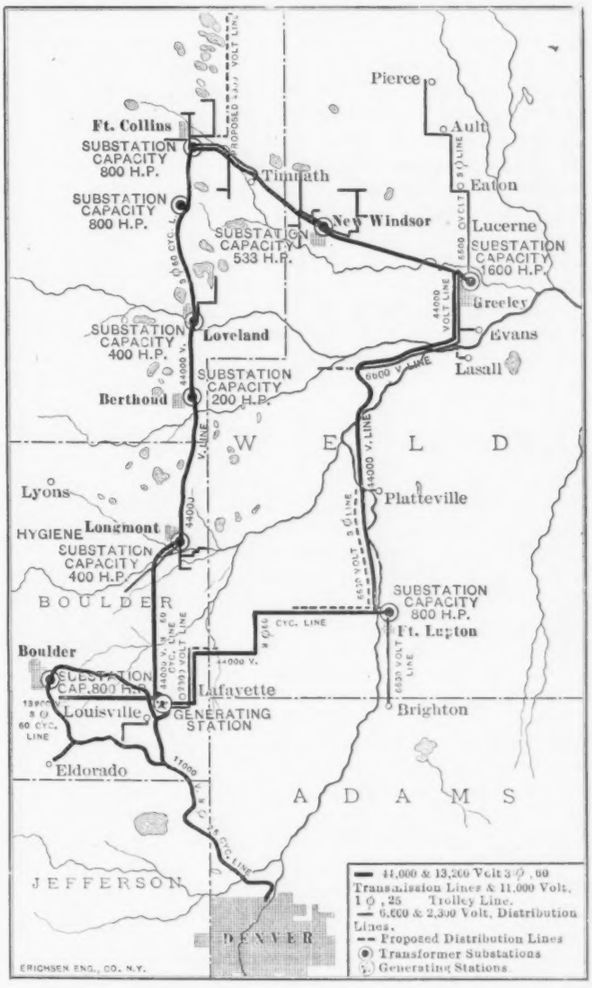


Fig. 1—Territory of Northern Colorado Power Company.

have remained in value at a price of from one to three dollars an acre, instead of from $100 to $500, as is now the case with irrigation.

The lands which lie above the ditch, or which have no rights for water from a ditch or reservoir, are sold within this territory at from $15 to $40 per acre, anticipating the application of water at some future day. Under this entire territory underflow water is found, and the installation of the pumping plants immediately increases the value of the lands. These values range from $100 to $500 per acre, the variation in price being regulated by the proximity of the land to market and to shipping point.

EARLY IRRIGATION WATER RIGHTS.

The original work of irrigation as carried on in the arid West consisted, first, of leading off a certain part of the

flow of streams and rivers by means of open ditches to carry water to the lands bordering on these waterways. This was successful and led to carrying the ditches farther from the streams and running branches from the mains to cover territory lying farther back and then damming up the streams to take off greater volume. Soon stream flows were depleted during irrigation time and means were taken to conserve the run-off waters at the time of greatest flow, when water was not needed for immediate use.

Large reservoirs were built so that flood water could be stored up near the source and made available on the lands below months after storage, when plant life needs the water in its growing period. As long as water was available more land was taken on to be supplied from every ditch, and contracts were entered into by the men owning the reservoirs to furnish water sometimes in excess of capacities.

The way that rights to water were secured was, first, the farmer took the water and put the same to beneficial use, and "beneficial use" is looked upon by all the courts as one of the strongest points in determining the relative rights of two or more contesting parties. The party who has made use of water files with the State authorities a claim, in which he states the amount of water he intends to use, the purpose for which water will be taken, and the means whereby diversion will be made. This application makes a record of the filing and is resorted to by courts when several disputing claimants ask adjudication of their rights.

The water rights of farmers ordinarily consist of a decree for a certain amount of water issued by the State to applicants, and usually these decrees have been passed on and adjudicated by the courts.

At the early stage of irrigation work abundant water was available and little thought was given to legality of rights or certainty of supplies. During later years tracts of land have suffered from continued drought, either from lack of water in the reservoirs and ditches or from the rulings of the men who are intrusted with the refereeing of the water distribution, and this has oftentimes resulted in crop failures, when farmers were compelled to watch their crops burn up, while water under question was allowed to pass their farms through streams or ditches to territory further down.

The water rights in all the arid States are subjects of continued and expensive strife. A man who thoroughly believes that his water rights on one day are beyond a question finds court decisions taking them away from him the next. The matter of appropriations in the several Western States has been most loosely handled in the early days, and filings have been made on streams which cover many times the total flow recorded, or even probable, when the drainage area is considered.

WATER-RIGHT DECREES ON UNDERFLOW.

As yet the legislators have enacted no specific laws to govern the decrees for underflow, but this is bound to come, and when it does the plants already built will have established prior rights of no small value by the beneficial use of water so obtained.

The farmers are beginning to appreciate the value and importance of making proper record of the dates and means by which this underflow is being put to use upon their lands, and now are filling out the forms furnished by the transmission company, and they are filing the records with the State engineer and in so doing are establishing rights which will become of much value in the future.

Although the underflow and surface waters have a common origin in the mountains, they are quite distinct when once they leave their source. The greatest snowfall comes at highest altitudes, as the moisture-laden winds in contact with the lower temperatures precipitate their moisture in the form of rain or snow. These rains and snows are held as storage in the mountains in the form of snow and ice, and in the reservoirs constructed for impounding waters at the time of greatest run off. A certain portion of these waters finds its way to streams and rivers, and from these the water is led to ditches and to reservoirs to facilitate its handling at the proper time.

EXTENT OF UNDERFLOW.

Another very large amount of mountain water finds its way into a loose and gravelly stratum lying between two sheets of strata impervious to water. This stratum extends out from the mountains to the plains at a fairly uniform distance below the surface of the land, and the waters contained are carried out toward the Mississippi Valley, where they appear upon the surface in the form of springs.

In this territory the average distance at which this water can be reached is from 20 to 25 ft. below the surface, and it is on this tremendous body of water or underflow that the greatest developments in the future will depend. The subsurface water can be considered as being held between two monstrous, tough, elastic sheets, which stretch out from the foothills to the plains and retain the water thus contained unless the sheets are punctured. In digging wells it is generally found that on a stretch of land irregular in contour water can be found at lesser depths upon the high lands than in the draws or valley. An explanation for this is apparent. Originally the water was held at a uniform depth below the surface. When upheavals came the disturbances which made the hills and valleys carried the water-bearing strata with them, but by the action of the elements erosion gradually took place and this in part removed the covering of the water on the higher lands and deposited it below, which left the distance from the surface of the ground to water much less upon the hills than in the valleys.

The action of the water in the ground is similar to that upon the surface, and a definite direction of the flow can be determined, although the flow is much less rapid, due to the obstructions of the soil.

PREDETERMINING UNDERFLOW.

Considerable work must be done to predetermine the quantity and location of the underflow before the actual work of digging wells is undertaken. One method which promises to produce results is carried on as follows. A special apparatus is built for drilling small, deep holes, and provision is made for taking out the core without disturbing the relative positions of the strata or the materials which make up the core. A hole is drilled and the test core taken out and analyzed, from which are found the depth of water-bearing strata below the surface of the ground, the thickness and the porosity of the strata. The water content of the strata is then determined from direct measurements. After these determinations have been made, the operation is repeated on a number of holes put down upon a 5-ft. radius, the first hole being taken as a center. All of the determinations made upon the first are repeated in the later holes to check the accuracy of the first determinations.

At this point in the test a standard chemical solution is introduced in the first hole and by means of galvanometric measurements the rate of flow from one hole to the other is determined, and from these tests are found not only the approximate rate of flow but the direction of the underflow as well. Holes are then put down at such a distance from the first hole that an hour's time will be consumed for the water to flow from the first hole to the last one. Several holes are drilled upon the radius of this larger circle and determinations checked upon each other as before. When the amount of water present and the rate at which it passes through the ground is found, the quantity of water which can be removed by pumping is fixed within the limits of a very small amount.

Where these conditions can be measured accurately, the amount of water that can be secured can be determined with much greater accuracy than can that of surface streams, because the waters found below the surface in

the underflow are subject to fewer factors of uncertainty, since seepage in and out and evaporation in its several forms are factors which amount to practically nothing in the underflow.

Where wells have been installed at frequent intervals and the topography and geology are quite thoroughly understood, the underflow can be determined with precision.

Fig. 2—Fields in Colorado Agricultural District.

When irrigators realized the limits of the surface flow and experienced the losses from uncertainties of supply, the question of making use of the vast storehouse of the waters underneath their lands was brought to them most forcefully. Every step of investigation pointed more clearly to the fact that surface waters were limited in proportion to the demands, and extensive use of underflow must be adopted to supply demands for irrigation needs.

ELECTRIC PUMPING OF UNDERFLOW.

Realizing the situation on this water question, and recognizing the demands to come, the Northern Colorado Power Company was formed to generate cheap energy in the lignite coal fields and to distribute this for irrigation pumping work throughout the richest agricultural part of Colorado and Wyoming, and to supply the needs for lighting, motor and railway service of the 120,000 people in the territory contiguous to the lines.

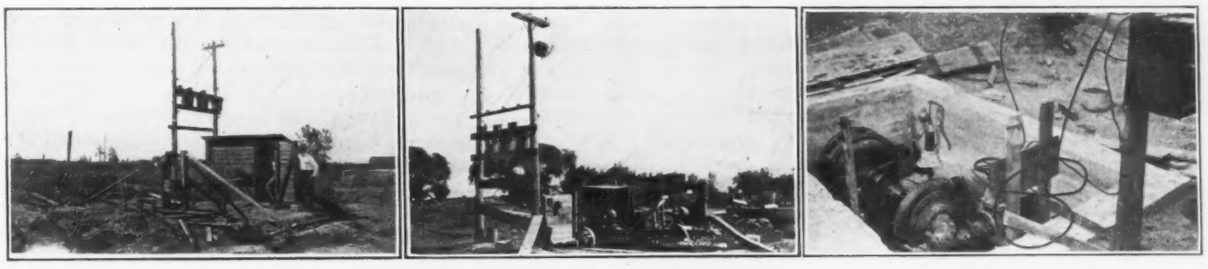


Fig. 3—Electrically Driven Pumping Stations.

Fig. 4—Electrically Driven Pumping Stations.

The territory supplied with energy by this concern extends from Denver, Col., on the south, to Cheyenne, Wyo., on the north, and from the foothills of the Rocky Mountains on the west to a line some 50 miles eastward on the plains.

MAIN POWER PLANT

The main power house is located in Colorado between the towns of Louisville and Lafayette, on the Colorado & Southern Railway, 15 miles northwest of Denver, and at the company's coal mines, in the center of the northern lignite fields, and at a place where a 26,000,000-cu. ft. reservoir is available for condensing water. Energy at 13,200 volts is generated by Parsons turbines running condensing which receive their steam from high-pressure boilers, fed with automatic stokers equipped with economizers, superheaters and induced draft, and take their coal from the mines below the plant, consume it and discharge the refuse mechanically throughout.

TRANSMISSION LINES.

From the power house a main transmission line carrying 60-cycle, three-phase, 44,000-volt energy is built due north, then east, and a second line extending east and north connects with the first-named line at Greeley, Col., forming a closed loop of transmission line, inclosing an area of 940 sq. miles, and from these lines are branches running out in all directions carrying leads of 13,200, 6600 and 2300 volts.

The system supplies the local towns with commercial lighting and motor service, lights the streets and furnishes all the intervening and surrounding territory with service from low-tension mains, and also supplies energy for urban and interurban railroads.

The Colorado towns to which the lines extend are Boulder, Louisville, Lafayette, Superior, Longmont, Niwot, Berthoud, Loveland, Fort Collins, Wellington, Tinmath,

Windsor, Severance, Greeley, Lucerne, Eaton, Ault, Pierce, Evans, LaSalle, Milliken, Johnstown, Platteville, Fort Lupton, Brighton, Henderson, Traceyville, Frederick, Firestone, Dacona, Erie and Canfield, all encircled in the richest agricultural district of northern Colorado.

Substations and switching stations are located about 20 miles apart along the high-tension line, and switches are so arranged that any substation on any section of line between the towns can be cut out without disturbing the remaining lines or interrupting service. Wooden-pole construction is used throughout with forty poles to the mile; on the poles which carry the high-tension transmission line low-voltage three-phase lines are carried from one substation to the next, from which the lateral pumping leads crisscross the country and furnish service to the pumping plants.

WELLS FOR PUMPING PLANTS.

The territory covered by these lines is underlaid with water-bearing strata. This water can be cheaply raised by pumps from wells and used for irrigation work.

There are two means commonly employed in Colorado for the building of wells for irrigation pumps. One consists in the digging of a well usually circular in form, but preferably rectangular, by excavating to the level of the water-bearing strata and by placing concrete curbings upon steel shoes which, after being weighted down, are lowered to the proper level by pumping the loose sand and gravel from beneath. The entire curbing is lowered in this way a sufficient distance to insure a free inflow of the water to the well.

Another means employed is that of excavating to the water-bearing strata and installing curbing, after which slotted casings are sunk down through the water-bearing strata to insure a ready flow of water to the well. Use is made of from 10-in. to 12-in. casings and the number necessary ranges from four to twelve to the well.

When a stratum of quicksand is encountered one casing is placed inside another so that no open slots are presented to the surface of the shifting sand, and clogging of the well is thus prevented. The circular wells are built from 10 ft. to 20 ft. across, and the rectangular ones 4 ft. to 5 ft. in one dimension by 10 ft .to 20 ft. across the direction of the underflowing water.

A structural-steel framework built up of I-beams, latticed across for strength, carries a vertical shaft which transmits the torque from a vertical-type motor located at the top of the well directly over the pump or belted to a motor in a housing at one side. The pump is fastened securely to the rigid frame at the bottom of the well and is submerged where a sufficient amount of water is available.

The placing of the motor at one side and belting to the shaft posssesses one advantage in that the framework can be more readily withdrawn and the pump inspected or repaired without the handling of the motor.

PUMPING-PLANT EQUIPMENT.

The pumping-plant equipment consists of a centrifugal pump, single or multiple stage, driven by a 2300-volt, three-phase, 60-cycle induction motor. The discharge from the pump is carried through long and easy bends of light steel pipe in order to reduce the friction head to minimum.

A standard type of panel, carrying a meter, fuses and no-voltage and overload release, is used. A housing for the motor and controlling apparatus is built of concrete blocks with patent roof and cement floor, and the consumer is encouraged to go to this expense to protect his motor and equipment.

PUMPING COSTS.

An endeavor has been made to secure accurate figures on the cost and operation of the average electrically driven pumping plant, and careful observations and tests were made on fifty-seven of these plants installed and operated during the pumping season of 1910.

In compiling data the following information was determined for each plant:

The number of acres under irrigation of each crop grown, such as beets, alfalfa, potatoes, truck or grain. The source of the supply of water, such as well, ditch, reservoir or drainage sump. The total static head, as measured from the surface of supply to the discharge of the pipe line at the highest point. The length and size of pipe line from the pump. The type, make, size, rating and efficiency of pump. The make, size, speed and characteristics of the motor drive. The individual costs of motor, wiring, pump, transformer, if the same are used. The cost of well, pipe line and the trenching. The housing for the well and motor and the miscellaneous costs attendant. All of these were figured up in detail and the total cost summed up and shown in total for each plant.

From these figures it is shown that under average conditions where pumping plants are used to cover 160-acre tracts (the average now in use) and lift the water through a 25-ft. head, the farmer makes an investment of $7.45 per acre to install a good efficient plant, complete in every way, ready to furnish water to the crops.

OPERATING COSTS.

The actual cost of operation was more difficult to ascertain, and tests of water have been made repeatedly on plants. At first the operating costs would vary widely, due to lack of proper installation and use of pumps unsuited to the work.

The average efficiency of a well-built motor-driven pump, including both the motor and the pump, is fairly taken at 50 per cent on actual working duty. It is an easy matter to fall below this mark if careful attention is not given to the selection of the apparatus, and a centrifugal pump operating under a different head or speed from that designed can give most disappointing results.

With constant tests and changes fairly uniform results have been obtained, and with a plant as noted, pumping from a well covering 160 acres through a 25-ft. lift, the farmers' cost will vary from $1.75 to $2.25 per acre-foot; that is, the expense per season totals this amount to cover each acre with water 1 ft. deep, and 1 ft. of water is the amount used in excess of the rainfall in this section or is the amount pumped.

COST OF PUMPING VERSUS. DITCH RIGHTS.

In comparison with these figures of supplying water through a pumping plant, it is interesting to note the average cost to a user when water is taken from a ditch or reservoir, the usual method of supplying water.

Water rights in northern Colorado to-day are fairly worth $60 per acre on the average, and this is subject to a minimum cost for maintenance of $1 per acre per year. This applies to rights for water taken directly from the streams, as well as storage rights, whether individual or operated by communities, and this cost is taken low. With the older water rights the actual cost of the water will probably average about one-quarter of the market value of the water rights to-day, and the price is rapidly increasing.

On the other hand, there is an investment charge of $7.45 per acre for the pumping plant against $60 per acre for ditch and water rights, and an average of $2 per acre operating cost for the pumping plant against $1 for the maintenance cost on ditch and water rights.

SAVING BY PUMPING.

With the fixed charge of interest at 6 per cent and depreciation at 4 per cent, or 10 per cent in all, and 6 per cent interest only on the water-right investment, the ultimate cost to the farmer for his water amounts to $2.75 for the pumping plant per acre-foot against $4.60 with ditch and water rights, with the tremendous advantage of being assured of water at just the time the water is required.

ADVANTAGE OF PUMPING.

The greatest advantage, according to the statement of the farmers who use pumps, is that the water is available at all times; that the work of irrigation can be carried on and water placed upon the growing crop at just the time and in the exact quantity which the crop demands. The importance of this factor cannot be overstated, and the very fact that water can be depended on when pumped has caused a large use of motors for this purpose by men who already had most excellent rights in water supply and ditches, but who have had experience in being unable to secure the water at the time and in the quantity desired, and who have found that failure to get water as required resulted in at least a partial loss of crops.

USE OF WATER.

From every ditch a large amount of land is served, and where water is available in the ditch it is necessary for those in charge so to portion out the water that one consumer cannot take water from the ditch more often than once in several weeks, between which times it is probable that the day will come and go when water would have proved the greatest value to his crop.

With pumping, the irrigator is not in any way dependent on the rulings of the officers of the company from which he has his rights, nor upon the dictates of the State authorities who control the distribution of the waters of the streams. This is conceded by every man who operates a pumping plant.

The investment for a pumping plant is used for other purposes. A large number of pumping motors are so installed that these can be removed and used for other purposes.

STOCK FEEDING.

In northern Colorado tremendous herds of cattle are fed for market every fall. These animals are bought in poor condition in the south and from the range; they are shipped or driven in and put in feeding yards, and given all that they can eat for a period covering two or three months' time and then they are quickly rushed to market.

Much knowledge has been gained along the line of scientific feeding in the last few years, and farmers claim that they can realize an increase of some 30 per cent in chopping and grinding the products of their farms and making food for stock and feeding and marketing their products in the form of beef, instead of produce on the open market as before. It has been clearly shown that cattle fattened on this kind of food are ready for the market from thirty to sixty days earlier than cattle which feed themselves from stacks. This work requires the installation of a motor varying in rating from 15 to 30 hp.

FEED GRINDING.

When grains are ground for feed the value of the food is doubled, and the cost of grinding is small compared with the benefits derived. The cost of energy used upon the farm is estimated upon the basis of the pumping energy and with these rates the cost per ton for grinding feed is: Corn, 24 cents; barley, 36 cents; alfalfa, chopped, 30 cents; alfalfa meal, 52 cents.

All kinds of cellulose matter are worked up in this way, and this, sometimes enriched with just the right amount of sugar (usualy the refuse of the factory), is found to yield most excellent returns when fed to cattle which have grazed upon the range. The stock will eat this food when chopped and fed in troughs, although they would trample under foot the same material in the stack and sometimes lose in weight, instead of fatten, as they do upon the food when ground. The beef produced is not of the highest grade and goes upon the market as "pulp-fed."

ELECTRICITY ON THE FARM.

The farmers find a varied use for electricity. The dairy farmers use electric drive on suction milkers and to operate the separators which extract the cream, to operate the deep-well pumps for service at the house and watering of stock, which gives the cattle clean water of a constant temperature instead of from the ditch—frozen in winter and warm and contaminated in the summertime. The dairy farmer finds it pays to put up ventilating fans in cow barns, which, besides adding to the comfort of his stock by driving away flies, produce sanitary products from his herd.

The poultry farmer uses incubators operated with electricity and finds the constant temperature of great service in producing good results.

The pumping motor has displaced the traction engine for use in threshing grains at harvest time, and the uniformity of the drive is readily appreciated by the farmer in securing better yields per acre, in that the screens can be adjusted so that loss of grain into the straw stack is reduced to almost nothing and fire hazards are entirely removed.

On nearly every farm where pumping is installed the house and barns are lighted with electric lamps, a small repair shop with a forge and blacksmith's drill is fitted with

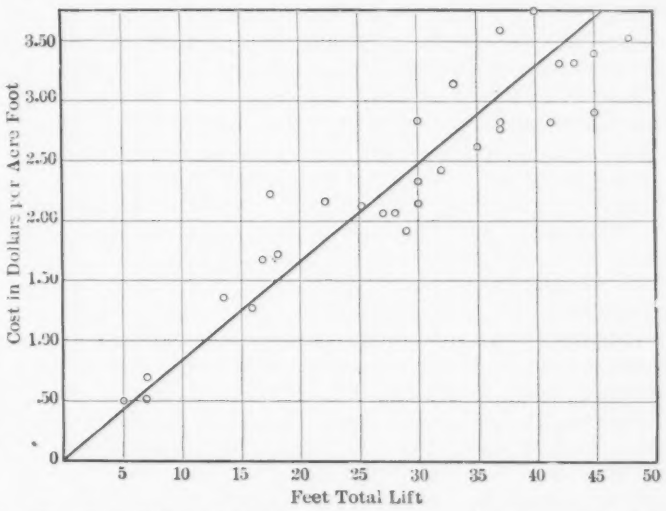


Fig. 5—Relation of Cost of Irrigation Pumping to Total Lift.

electric drive, and motors are fitted with back gears and drums for hoisting hay into the barn.

The housewife on the farm is a better prospective customer for the sale of small appliances than is the average city housewife, and buys the more practical ones, such as irons, fans and heating devices.

An attempt is now being made to introduce the German method of cable plowing, which can be undertaken with only a small additional expense when motors have been purchased for the other work.

ALKALI LANDS

In much of the older irrigated lands it has been found that continued irrigation has raised the water table so that waters have been brought up to the surface.

Where continued rapid evaporation has gone on the waters percolating through the soil have taken up large quantities of salts which are always present in the soil, and with evaporation at the surface the salts are left behind. These salts are very largely sodium sulphate and sodium carbonate, and are helpful to the growth of plants when present in normal quantities. When these become excessive the effect is most pronounced and any form of plant life fails to thrive. In arid countries, where evaporation is excessive, the deposit at the surface is pronounced where quantities of water percolate the soil. The lands where this takes place are considered salty, or are known as alkaline, and serve no useful purpose when in this condition.

The reclamation of these lands is easy and the cost is small. A system of drainage pipes is introduced below the

surface and the soil is washed with water, until the water is surcharged with alkali. This water is then carried to the surface and pumped away. The installation of the drainage pipes below the surface when the salting first begins allows filtration to take place, and then, by pumping to maintain a lower level of the water table, it keeps the deposits below the danger point, and oftentimes allows of the irrigation of large tracts of land which lie above those reclaimed.

The importance of this work of prevention and the work of reclamation of the soil is not thoroughly appreciated as yet, although in every irrigated district can be seen marked evidence of this difficulty coming on. Although this work of washing out is just beginning, it is evident that a tremendous field is being opened for the use of electricity in reclamation of this kind, even when the irrigation work is from the ditch and reservoir.

DEVELOPING MOTOR-SERVICE BUSINESS ON THE FARM.

The introduction of the use of electricity on the farm is a work of education. The work of securing the pumping business is undertaken first and this is followed by securing other business after the pumping plant is in. The method of securing pumping business has been as follows: A personal canvass has been made on territory covered by the electric lines and active solicitation has been carried on for two years' time.

An educational campaign has been carried on through the local newspapers and periodicals which find their way into the hands of the farmers and a series of "follow-up letters" is sent to prospective customers to assist the solicitation. Where lands are found adaptable to pumping, the representative first makes a survey of the conditions to be met in the installing of a pumping plant, and an endeavor is made to determine upon the best location for the well on the land to be irrigated, first cost of construction and cost of delivery of water both being given due consideration. An estimate is made to show the cost of installation to the owner of the land, including the cost of well, pump, motor, pipe, housing and transformers—if a motor designed for less than 2300 volts is used. An estimate is also made of cost of operation, including cost of energy, maintenance and repairs, and the final figures in cost of water per acre-foot is given.

The prospective consumer is given the names and addresses of all pumping consumers within a reasonable distance from his lands, and the detailed costs of each are shown to him so that he can communicate with those who are already users and verify the figures given him.

Frequent trips are made with motor cars, on which a group of prospective consumers are taken to operating plants to see them work and to go over questions of adaptability with the owners of the plants, and also get at first hand comparisons on costs of pumping with electric energy, steam and gasoline, and it is found that this method of promoting installations convinces a prospective user more readily than any other.

When gasoline is found already in use, small difficulty is experienced in displacing the service, as the plants are necessarily located at a distance from supplies and expert help.

CONTRACT.

A contract is entered into with the owner of the land for a period of either five or ten years. The basis on which the pumping energy is sold is that of a "readiness to serve" charge of $1 per horse-power installed per month, for the irrigation months as specified, and usually covers the months of May, June, July, August and September, to which is added a consumption charge of 3 cents per kw-hour as measured with the 2300-volt, three-phase meter.

In case the pumping plant requires the construction of considerable pole line, provision is made in the contract to protect the company by having the minimum proportioned to cover one-half the construction costs each year. This minimum amount is payable each year for the five-year or ten-year period, as the case may be.

It frequently occurs that a prospective consumer desires a pumping plant installed, requiring the building of a considerable stretch of line, and in each case the agreement on the annual construction minimum provides that on securing other pumping contracts which can be fed from the line on which the first consumer pays a minimum, the minimum charge will be reduced to the first consumer and charged to the second one, in direct proportion to the size of the plants.

This arrangement has worked out well for both the farmer and the company, in that the farmer has been able to secure his plant, and by his efforts has procured an installation on the farm adjoining, thus cutting down the minimum for himself and securing added business for the company.

In some instances extensions have been made wherein the consumer has advanced construction costs, and these in turn are paid back to him in rebates, taking a percentage of the bill, after he consumes a certain minimum amount per year. These amounts apply upon the line extension, title to which is vested in the transmission company after a certain period is covered.

FLAT RATES.

No contracts have been made wherein flat rates are used, as these work to the detriment of both the owner of the land and of the transmission company. The tendency exists to use more energy than is needed, and this results not only in a low rate to the company but in a loss of crops to the irrigator from use of too much water. The chemists of the sugar companies claim that where unlimited water is available the per cent of saccharine in beets has been reduced by 20 per cent by over-irrigation.

All pumping contracts are so drawn that the consumers agree to use no energy at the peak-load hours whenever the transmission company so demands. In starting up this class of business, the company aimed to have installed one plant which operated satisfactorily in the immediate vicinity of each town served. In this it was successful the first year, and the greatest care was given every plant to see that operations were successful.

THE FARMER AS A CONSUMER.

The farmer, as a class, is a consumer hard to reach, and time is necessary for the closing of each contract. When first approached, the farmer has in mind that electric service is not suited for his needs, that it has a field in towns for lighting and in the shops for motor service, but he never has considered it as a substitute for the animal power he has always used.

When once secured, the farmer makes a splendid customer. He knows his wants and can pay for his equipment. When once he becomes a customer he seldom disconnects his installation, and he offers a splendid prospect for use of energy in other lines. He depends upon the marketing of his crops to pay his bills, but pays them at that time, and he is able to secure large credit when required from the country banks in his vicinity.

DESIRABLE BUSINESS.

The business which this pumping load brings on is most desirable and permanent, and is as certain as agriculture itself. The desirability of the pumping load, when added to the average load secured in serving towns of small size, is best shown by means of load curves, which give the load conditions as they exist during the winter period and the conditions found with the addition of the summer pumping load. The power demands in the winter time are 160 per cent of that of summer, but the summer energy output is equal to that of the winter time, with 25,000 acres covered.

Development work along this line has just begun and the effect so far produced makes clear the fact that a condition will arise—and that within a three years' period at the

present rate of change—wherein the peak demands upon the plant and lines will come upon a summer afternoon instead of in the winter evenings. With this condition the annual load factor will exceed any that can be found in public-service plants.

The towns within this territory are all dependent on the agricultural work, and each additional acre irrigated means added industries to the towns and added requirements for energy. The one builds up the other and each supplies the market that the other needs.

RESISTOR MATERIAL WITH VARIABLE TEMPERATURE-RESISTANCE COEFFICIENT.

By L. Körber.

METAL is employed almost exclusively to-day for electric resistor material, use being made of iron, platinum, manganin, nickelin, kruppin and other alloys. All these materials, save the manganin, which has a very small negative temperature-resistance coefficient, have positive temperature-resistance coefficients. Resistors with negative temperature-resistance coefficients and capable of withstanding temperatures up to 500 deg. C. without alteration of their character have been unknown hitherto. The disadvantages of the materials enumerated above when used as resistor materials consist on the one hand in their requiring much space and on the other hand in the chemical alteration they undergo in consequence of the passage of the electric current. After being in use for some time the material gets brittle. This feature is conspicuous in all systems where electric resistors are used as heaters. From all the resistors nowadays in use for heating purposes, such as naked wire furnaces, heating bodies with insulated conductors, luminous heating bodies, the metalloceramic resistors made by Parvillié Brothers at Paris thoroughly differ, in consisting of combinations of non-conductors in certain proportions with conductors. The process used by Parvillié Brothers is about as follows: Nickel with quartz and kaolin, and with fluxes which prevent oxidation of the metal, is melted at a high temperature and the mass thus obtained is molded under hydraulic pressure into slabs or rods. The ends of the rods are provided with brass sockets. Heating bodies made of such resistors primarily admit of rapid heating to high temperatures, but after a short time the emission of heat diminishes in consequence of the resistors being internally melted.

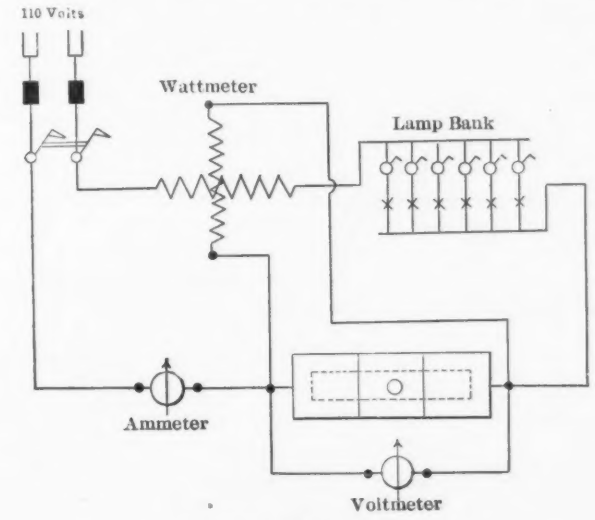


Fig. 1—Test Connections.

There are two causes of the short life of this material, namely, the employment of a base metal and the existence of bad contacts. In fact, in consequence of the passage of the electric current, the nickel employed becomes oxidized after a short time and at the points where oxidation goes on most rapidly melting sets in and the resistors are destroyed. In order to avoid the formation of sparks at the contact points the makers enrich the ends of the resistors with the powder of nickel. In consequence of the jamming of the resistors in metal clamps a high intermediate resistance is created between the clamps and the resistor body, the resistance manifesting itself by rise in temperature locally. The enriching with a base metal—nickel—does not afford any advantage, because in this case also oxidation and melting through at the contact points take place.

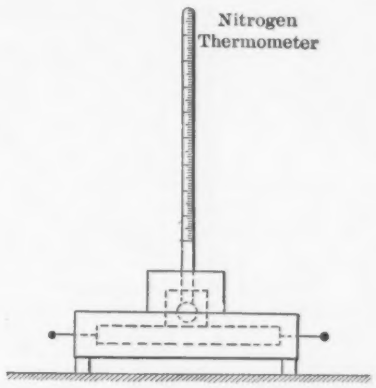


Fig. 2—Arrangement of Thermometer.

A long series of experiments has shown that the main conditions for the creation of a resistor material able to maintain a constant resistance at high temperatures, up to 600 deg. C., are the employment of a precious metal and of suitable contacts. Recently resistors have been built with variable temperature-resistance coefficient which contain the precious metal silver as the main conductor material. The difficulty to be overcome consisted in binding the necessary quantity of this metal to the oxides of the metals to be added in order to give the resistor material its desired resistance characteristic.

For this purpose use was made of metallic aluminum or magnesium. The process of making the resistor material is as follows: A precious metal, such as silver, gold or platinum, in powdered state, is mixed with a liquid silicate, for instance, potassium or sodium waterglass, a manganese compound and aluminum being also added, and the mass thus obtained is calcined in a crucible at a temperature of about 1000 deg. C. The resulting product is freed from

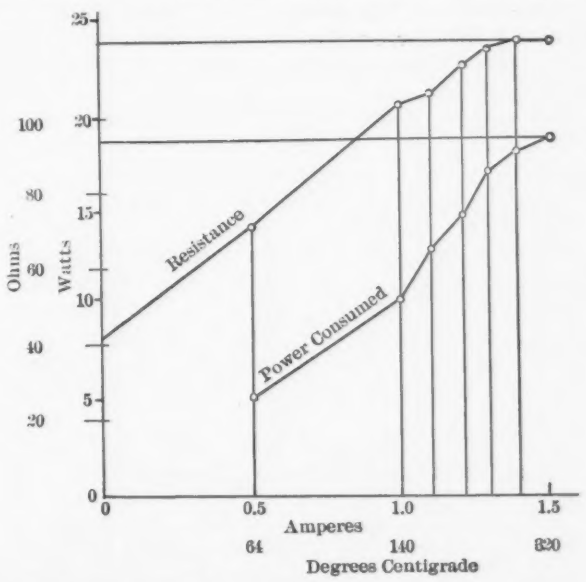


Fig. 3—Resistance of and Power Consumed by the Resistor.

all unburnt particles of aluminum, kneaded with a suitable cement into a plastic mass and pressed into molds.

A suitable composition of a resistor having a negative temperature-resistance coefficient is as follows: From seven to eight parts of silver, from eight to ten parts of

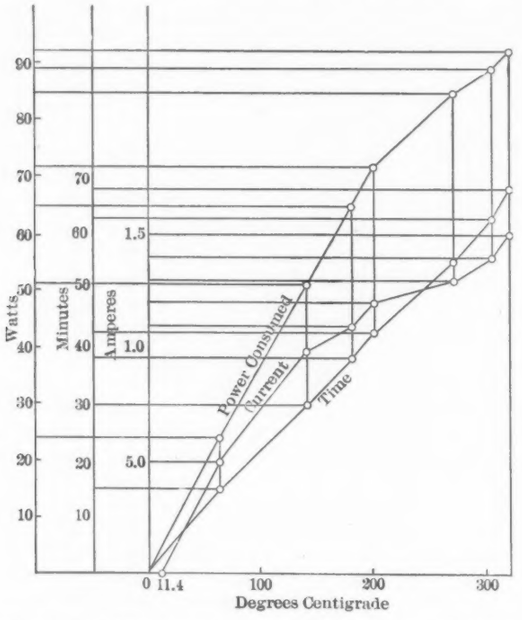


Fig. 4—Variation of Current and Power with Temperature.

potassium or sodium waterglass, four parts of peroxide of manganese and one-half part of aluminum.

A resistor having a positive temperature-resistance coefficient may to advantage be composed as follows: Ten parts of silver, from one-fifth to one-half part of peroxide of manganese, ten parts of potassium or sodium waterglass and from one to two parts of aluminum.

As already stated the employment of precious metals is a necessary condition by reason of their little affinity for oxygen and the necessity for high temperatures in the resistor. On the quantity of the manganese compound entering the mixture depends the character of the prepared resistor. When larger quantities of this compound are employed the resistor shows a negative temperature-resistance coefficient, and when smaller quantities are employed a positive coefficient. This special quality is peculiar to the compounds of manganese. The passing from the positive to the negative through the zero temperature-resistance coefficient takes place when about 5 per cent of the manganese compound is present. The aluminum or magnesium is necessary for binding the requisite quantity of the precious metal, for if it be dispensed with a portion of the silver employed would separate in the metallic state during the calcining process. Such a resistor would be unfit for use, as it contains too little precious metal and would therefore soon be melted by the passage of the electric current.

The reaction process, which is of an exothermic nature, shows that aluminum is necessary for binding the silver. Moreover, the aluminum converted into aluminium oxide by the burning also constitutes a resistor material. This is seen from the fact that as the percentage of aluminum contained in the resistor material increases the resistance rises.

It has already been mentioned that faultless contacts play a prominent part in the resistors. For this purpose the contacts are made as follows: The resistor material is placed in a mold and at the points where the contacts are to be formed use is made of material composed of the main resistor mass and a powder of precious metal. Into this layer, richer in precious metal, the conductors of precious metal, advantageously made of silver wire, are embedded in such a manner that the end of the silver wire projecting into the mass is wholly surrounded by the layer richer in precious metal. Subsequently, the contact mass richer in precious metal is covered with the resistor mass, being completely inclosed thereby. By using precious metals for the outer layer and the conductor oxidation and heating at this point, which would cause deformation, are avoided and by embedding the contacts, instead of jamming and soldering them, alterations of the temperature-resistance coefficient are prevented.

It has been ascertained by experiments that when a resistor body with a negative temperature-resistance coefficient, the contacts of which were formed by soldering and subsequent galvanizing, was heated from 20 deg. C. to 300 deg. C. its resistance increased from 2.65 ohms to 3.7 ohms, thus indicating a positive temperature-resistance coefficient. This result shows the importance of the manner of forming the contacts.

The chemical nature of the product obtained by the burning process is such that it may be termed a kind of metal glass. Contrary to other processes no melting takes place during the chemical reaction. The mass, consisting of silver, a liquid silicate and aluminum, reacts at about 1000 deg. C. in the crucible, and after cooling it becomes a light-brown, grossly granulous power.

The resistors with variable temperature-resistance coefficient serve mainly for replacing the wire resistors nowadays used in motor controllers and for heating purposes. By reason of their compactness and convenience they are well suited for electrical purposes. For example, a resistor 100 mm in length and having a square cross-section of from 9 sq. mm to 16 sq. mm carries 2 amp. They can easily be replaced and they excel wire resistors in withstanding concussions.

THERMOELECTRIC CHARACTERISTICS.

A trial resistor with a positive temperature-resistance coefficient having the dimensions of 100 mm, 6 mm and 6 mm, and made of the material referred to above, was tested to determine its behavior on the passage of currents. The resistance of this experimental body in the cold state was 8.4 ohms. The temperature of the room, as indicated by a thermometer, was 11.4 deg. C. The trials were carried

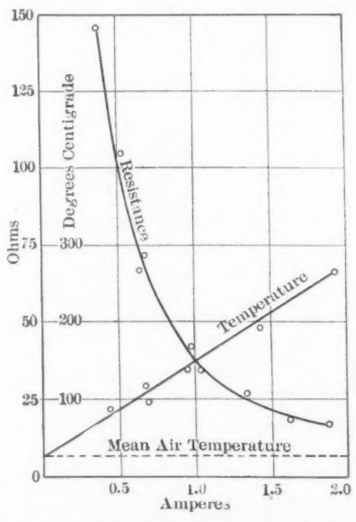


Fig. 5—Variation of Resistance and Temperature with Current.

through with the aid of alternating current, the electric connections of the installations being made according to the diagram of Fig. 1. From the simultaneous readings of current and voltage the resistance of the resistor body, heated by the current, was calculated. The power con-

sumed was ascertained by means of a precision wattmeter interposed into the circuit. The temperature on the surface of the resistor was observed by means of a nitrogen thermometer capable of indicating up to 400 deg. C. For the purpose of obtaining the most exact possible readings the trial resistor was inclosed in an eternite body provided with a cover and the thermometer could be lowered into the cover until the mercury bulb was placed just above the resistor, as shown in Fig. 2. In Fig. 3 the resistance of

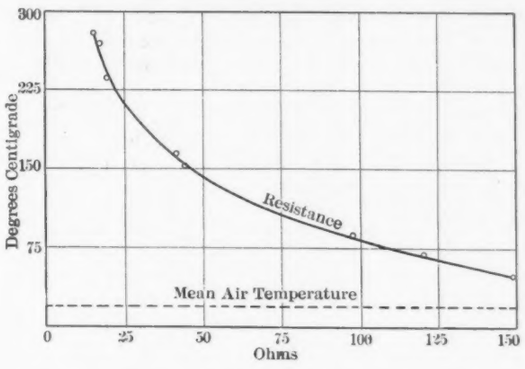


Fig. 6—Variation of Resistance with Temperature.

and the power consumed by the resistor are shown as functions of the strength of current. Fig. 4 shows the dependence of the strength of current, the power consumed and the necessary time in minutes on the temperature reached by the trial resistor. Up to a temperature of 320 deg. C. the resistance increased quite gradually. The characteristic features of a resistor of negative temperature-resistance coefficient are indicated in Figs. 5 and 6. At a rise of temperature from 0 deg. C. to 260 deg. C. the resistance decreased from 150 to 20 ohms.

THE CALCULATION OF WIRE SIZES FOR COILS.

By G. E. Marsh.

In the construction of apparatus involving ordinary wire-wound coils it is generally desirable to be able to ascertain by calculation, rather than by any experimental cut-and-try method, the size of wire that will enable the winding to fulfil certain prescribed conditions. It may be that the depth of the winding area is limited, or, at the most, must not exceed a fixed value, or that the winding space dimensions are stated and that the coil is to produce a maximum field strength with a given resistance or a specified heat production, or both.

In the first of several possible cases, suppose that it is desired to ascertain the size of wire that will give to a solenoid of specified length, inside radius and resistance the greatest field strength at the center of the core of the winding. It is hardly necessary to remark that the winding that is the best for one current is the best for any other, barring the heating effect, as the efficacy of the winding from the standpoint of magnetic field production is only dependent on the size, length and manner of winding of the conductor.

The symbols used have the following meanings: R, the resistance of the coil; n, the total number of turns in the coil; Φ, the field strength in gausses at the center of the coil; l, the length of the coil in centimeters; r, the inside radius of coil; r_m, the mean radius; t, the number of layers of wire; s, the specific resistance of the wire used, ohms per centimeter cube; p, the resistance per centimeter length of wire; d, the diameter of insulated wire; d_1, the diameter of the bare wire; $k_1 = d/d_1$, the ratio of the insulated to the bare wire; $k = R/4lsk_1^2$. All linear dimensions are expressed in centimeters. No bedding of the wire in winding is assumed. This characteristic of circular-sectioned conductors is in the ordinary case of no importance even though its action is favorable rather than otherwise.

In the case of a cylindrical solenoid of circular section the strength of the magnetic field at the center of the core is given by

$$\Phi = 4\pi ni \div 10\sqrt{l^2 + 4r_m^2} \qquad (1)$$

and the values obtained by the use of this formula are, in general, sufficiently close for all constructional needs, the accuracy, in any case, increasing as the ratio of the length to the mean radius of the coil becomes large.

A little inspection will show that the following relations may be written. The mean radius, the length of the mean turn, the number of turns per layer, the total number of turns and the total length of wire in the coil are given respectively by $(r + td/2)$, $2\pi r_m$, l/d, tl/d and $2\pi lt(r/d + t/2)$.

The resistance of the winding is $2\pi plt(r/d + t/2)$, and from this the number of layers is easily found to be

$$t = -\frac{r}{d} \pm \sqrt{\frac{r^2}{d^2} + \frac{R}{\pi lp}} \qquad (2)$$

In order that the significance of the double sign before the radical may be seen, consider equation (2) in words. This expression enables the number of layers of wire of diameter d and occupying a winding space of mean radius r_m and length l, and with a total resistance R, to be calculated. The value of r_m is greater than r if the latter be the inside radius, as is supposed here, and the corresponding value of t is given by using the plus sign before the radical. The use of the minus sign, on the other hand, refers to the case when r_m is less than r (r becoming the outside radius) and the wire is wound inwardly with decreasing radius and consequent reduction of diameter of core. This case is of no particular importance here.

The resistance per centimeter of wire is expressible as $4s/\pi d_1^2$ or $4sk_1^2/4d^2$. Introducing the values of p and k into equation (2) there is obtained

$$t = -\frac{r}{d} + \sqrt{\frac{r^2}{d^2} + kd^2}. \qquad (3)$$

Equation (1) may now be written in the form

$$\Phi = at \div d\sqrt{b + cdt + d^2t^2}, \qquad (4)$$

where $a = 4\pi li/10$, $b = l^2 + 4r^2$, and $c = 4r$.

The introduction of the value of t, the number of layers, from equation (3) into equation (4) and the solution of the resulting one for a maximum, d being the independent variable, results in the very interesting and simple expression:

$$d = \sqrt[4]{l^2/k}. \qquad (5)$$

The value of the diameter of the wire as given by the last equation is only approximate, and the degree of approximation is dependent on the values of the constants involved. In some cases the value is given more precisely than can be actually realized on, owing to the differences between consecutive wire-gage sizes. In others the best size of wire can be easily ascertained by a trial calculation or two, using the value as given by equation (5) as a guide in selecting a size once or twice removed from the one in hand. The simple form of the last expression is surprising in view of the complexity of the operation of reducing it, as any one with a fondness for lengthy calculus reductions can ascertain to his own satisfaction.

In order that the full significance of the last expression may be seen, let the problem be restated: If a cylindrical winding area of inside radius r, length l, is to be wound to a resistance R with wire of conductivity p, insulation thickness $(d - d_1)/2$, and to provide a field of maximum strength, then the wire of insulated diameter d, as given by equation (5), satisfies the conditions. A little examination of the values of the field strengths corresponding to respective values of arbitrarily chosen wire diameters will

reveal in any particular instance how much the magnetic intensity will be reduced by the use of a wire more or less different from the best size. As several factors enter the problem, it is impossible to say whether the maximum field strength will be one of sharply defined character or not, and an examination will be advisable before using a wire several sizes removed from the calculated value as the reduction in field strength may be too considerable to be sacrificed.

If equation (5) be rewritten in the form

$$d = \sqrt[4]{sd^2l^2/d_1^2R},$$

it is seen that the better the conductivity, the thinner the insulation of the wire, or both, the smaller is the wire size satisfying the conditions, which is in accordance with our knowledge of the case. Other things remaining the same, the diameter of the wire is halved by a sixteen-fold increase in the specified resistance and the diameter of the wire is increased 68 per cent when the length of the coil is doubled.

In the precise determination of any wire size it becomes necessary to use in the initial calculation an approximate value for the thickness of the insulation as that quantity is itself a variable and not known until the wire size is ascertained more or less closely. Accordingly two or more applications of the equation are generally necessary in order to determine the most nearly correct value of the wire diameter, using in the first calculation a value for the insulation selected by estimation alone and then correcting this from the resulting value of d. That a table of thicknesses of insulation of the kind of wire to be used is required hardly need be stated.

Coming now to the case in which the length, inside and outside radii of the winding space are specified, there are the relations

$$t = 2(r_m - r)/d, \quad n = 2l(r_m - r)/d^2.$$

The field intensity is given by

$$\Phi = Pi/d^2,$$

where P is the expression

$$8\pi l(r_m - r)/(10\, d^2 \sqrt{l^2 + 4r_m^2}).$$

The resistance is

$$16\, lsr_m k_1^2 (r_m - r)/d^4, \text{ or } k_2^2/d^4, \text{ say.}$$

The equation $R = k_2^2/d^4$ enables the wire size for coils of fixed dimensions and given resistance to be found at once.

As $i = \dfrac{e}{R + r_e}$, where e and r_e are respectively the emf and the resistance of the circuit not included in the coil, there is obtained at once

$$\Phi = Pe/(R + r_e)d^2. \qquad (6)$$

Proceeding in the usual manner and ignoring the thickness of the insulation, it can be shown that the field is a maximum when R equals r_e; that is, when the coil resistance equals that of the rest of the circuit, a relation that is well known. The value of the wire size in this case is given by

$$d_1 = \sqrt[4]{16\, lsr_m (r_m - r)/r_e}. \qquad (7)$$

And in those cases in which the insulation thickness is not negligible the maximum field strength of a coil of given winding space is secured by making its resistance R bear the same relation to the rest of the circuit r as the diameter of the bare wire d_1 bears to the insulated diameter d. This fixes R and the size of wire is clearly given by

$$\delta = \sqrt[4]{16\, k_1^2 lsr_m (r_m - r)/R}.$$

When the value of the wire size is found, the number of turns, layers, length of wire, field strength, etc., can be readily calculated.

If the I^2R loss and the current are specified, then R is known from the relation $R = w/i^2$, where w is the power consumed in heating the coil. This value of the resistance can be used and the corresponding condition of a given heat production introduced.

If the I^2R loss and the drop over the coil are given, the value of the resistance is h^2/w, where h is the drop and w has the same meaning as before. The use of this last-named resistance enables the corresponding conditions to be introduced into the problem.

A SERIES-PARALLEL TRANSFORMER SWITCHBOARD.

By Louis Derr.

For work with the electric furnace, especially in research, it is necessary to have at command large currents with a wide range of voltage at the furnace. If the supply voltage is fixed, bulky and wasteful resistors are necessary or for the alternating current a scarcely less cumbersome reactance coil, and it is very desirable to have a supply whose emf can be varied at pleasure. For work requiring heat alone apart from electrolysis the alternating current has many advantages, and the readers of this journal may be interested in a description of the method by which it is utilized in the electrochemical laboratory of the Massachusetts Institute of Technology. As the units are alike except in size, a description of one will serve as typical.

Power at 2300 volts is led to the primary of a 66-kw Pittsburgh transformer, which differs from the usual type in having twenty-two independent secondary coils, each capable of giving 300 amp at 10 volts. Each coil terminal is connected to the blade of a single-pole, double-throw switch, as indicated in Fig. 1, where terminals of the same polarity are marked with corresponding signs. The left-hand studs are connected to two busbars, as shown by the dotted lines, and the right-hand ones are linked in pairs also as indicated. From the illustration it is clear that if all the switches are thrown to the left the three coils connected to the switches will be thrown in parallel on the busbars. If the first and last switches are thrown to the left and the rest to the right, the three coils will be in series on the busbars, and this arrangement may obviously be extended to include any number of switches.

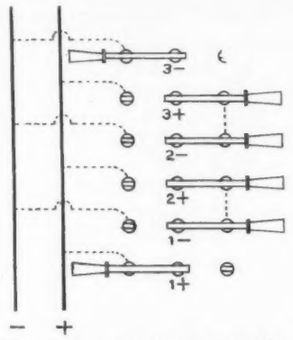


Fig. 1—Arrangement of Switches.

PERMISSIBLE OUTPUTS.

Volts.	Amperes.	Kilovolt-Amperes.
10	6,600	66
20	3,300	66
30	2,100	63
40	1,500	60
50	1,200	60
60	900	54
70	900	63
80 to 110	600	48 to 66
120 to 220	300	36 to 66

On the actual board alternate studs are made longer than the others, and one of the busbars is bolted directly upon the long studs while the other is connected by short, offset pieces to the short studs. This gives the simple construction shown in Fig. 2, which is a view of the back of the board before connection with the transformer. The forty-

four switches are mounted in double column for convenience in handling and economy of copper, and this arrangement has the incidental advantage of allowing the halves to be used separately if desired and at different voltages as well, as may be convenient.

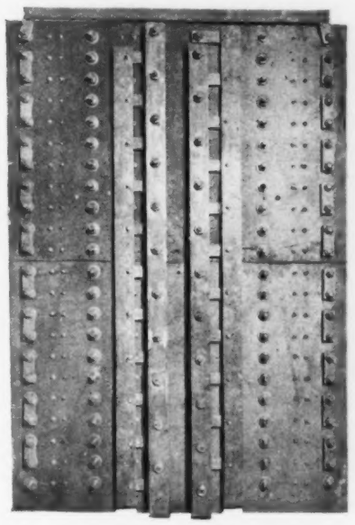


Fig. 2—Rear of Switchboard.

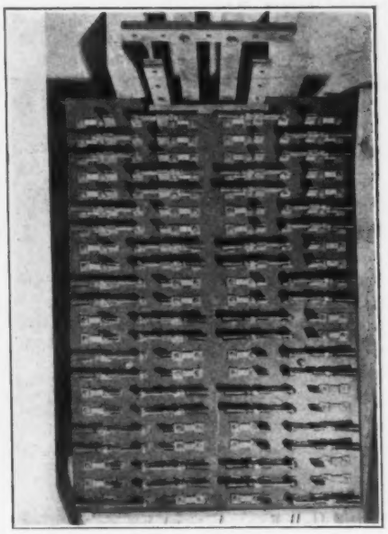


Fig. 3—Front of Switchboard.

In this way any emf up to 220 volts can be obtained in 10-volt steps by throwing in the needed number of coils, but the advantage of the arrangement does not stop here. The connections shown in Fig. 1 will give 300 amp at 30 volts since three coils are in series on the busbars. If more than 300 amp is needed it is merely necessary to treat the next group of three coils in precisely the same way, thus putting it in parallel with the first group. Other groups may be added in like manner, so that with this transformer seven groups of three coils each can be used, giving 2100 amp at 30 volts. Other combinations are, of course, possible. Fig. 3 is a view of the face of the board with the switches set for eleven groups in parallel, each having two coils in series and thus giving 3300 amp at 20 volts.

With any such series-parallel arrangement it is not always possible to utilize the full output of the transformer, but for most cases nearly all of it is available, as the table printed on the preceding page shows.

With this wide range of emf, covering practically all of the work of the laboratory, the question of ballast resistors is a simple one. In most cases a few strips of sheet iron or 2 ft. or 3 ft. of thick iron rod suffice, held in screw clamps and supported on two firebricks to give free circulation of air. Since the terminal emf is controllable, the power spent in the ballast resistors is small and it has not been found necessary to adopt the more troubesome iron pipe carrying a stream of water. For the not unusual requirement of an emf which must rise or fall rapidly it has been found by trial that the switch combinations can be changed to follow the furnace variations with all necessary speed.

Central Station

Management, Policies and Commercial Methods

A REMINDER TO NEW TENANTS.

Several central-station companies have printed post cards on tags which their representatives, when temporarily removing meters from vacated houses, hang to the chandeliers or place in a prominent location to inform future new tenants that the house is wired.

In Kansas City the new tenant moving into a house wired for service finds an envelope on which is printed, "Notice: How to Turn on Electric Light." Suspecting that the owner or former occupant has left a reminder (the envelope bears no trace of the electric company's name), the prospective customer finds inside a card beginning "Don't stay in the dark. Call 50 Main and arrange to have the electric service connected immediately." Below is a post-card form addressed to the company, which can be filled out and mailed without delay if desired.

A COMMERCIAL-VEHICLE GARAGE FOR KANSAS CITY.

To meet the need for a commercial-vehicle garage for electric-truck users in Kansas City, Mo., several officials of the Kansas City Electric Light Company have organized the Electric Truck Company, which is closely allied to the local central-station interests. The members of the garage corporation are Messrs. John M. Egan, Louis H. Egan and J. A. Harder, president, general manager and secretary, respectively, of the electric-light company. Mr. L. E. Marshall, formerly with the Commonwealth Edison Company, Chicago, is manager of the truck company, which will do a general sales and garage business at its garage, Thirteenth and Charlotte Streets.

In spite of the general hilly contour of Kansas City, about 350 electric pleasure cars are already in use there. An off-peak rate of 5 cents per kw-hour is granted for private garage users, the average income per car being $6.50 to $7 a month.

SOME ECONOMICS OF ELECTRIC COOKING.

A cheaper grade of coffee can be so prepared in an electric percolator as to be really quite superior to the more expensive coffees made ready in the usual way. Mrs. W. E. Sweezey, wife of the manager of the Junction City (Kan.) Electric Light Company, in telling of her own experience with electric cooking in a paper read before the Kansas State electrical convention, Sept. 21, declares that she finds 30-cent percolator coffee all that can be desired and has given up the use of the 40-cent grade, thus saving the difference between $15.60 and $11.70, or $3.90, a year in her coffee-bills.

Recently Mrs. Sweezey determined to make a test of the energy consumed by her electric cooking range in preparing a day's provender. The range used was of the General Electric type retailing at $75. On the day in question, after a breakfast of bacon and eggs, toast and coffee, a dinner of fried chicken with gravy, hot biscuits, baked sweet potatoes, mashed potatoes, peach pie and coffee, and a warmed-over supper, the total consumption shown by the meter was but 3 kw-hours. The Sweezey home is a completely motor-

equipped household and Mrs. Sweezey's example is rapidly educating her townswomen to the conveniences and comforts of electrical service.

A CUT-RATE HOUSE-WIRING CAMPAIGN AT JOPLIN, MO.

Taking a step beyond the usual "wiring-at-cost" offer, the Empire District Electric Company, operating in Joplin, Webb City, Mo., and Galena, Kan., stands ready to wire old houses at a price about 35 per cent below the usual local cost of such work.

Thus, for $17.75 the company will furnish and install, complete, wiring, fixtures and tungsten lamps for a house of five rooms as follows: Living-room, one two-lamp fixture; dining-room, one two-lamp fixture; bedroom, kitchen, bathroom and porch, one lamp each. The price, $17.75, may be paid $2.75 down, followed by twelve monthly payments of $1.25 each. The company's rates for residence service are 8 cents per kw-hour for the first 25 kw-hours and 5 cents thereafter.

The present house-wiring campaign began June 1 and was planned to close Oct. 1. Out of the total population affected by the offer, 35,000 people, an average of seventy-five old houses per month have been contracted for wiring. For the final month of September it is expected that this number will be doubled. With each house wired an electric iron has been placed for thirty days' free trial, most of these iron installations becoming *bona fide* purchases at the expiration of the month. A number of electric toasters have also been installed. The fixtures furnished with the $17.75 wiring offer are of simple but good design and the customer is furnished with 40-watt or 60-watt lamps, as he chooses, but may have larger lamps by paying a small excess. None of the tungsten lamps are, of course, exchangeable after the first filling.

The house-wiring campaign in the towns of the Empire District, which is a famous lead and zinc-mining country, has been carried on under the direction of Mr. J. E. Harsh, contract agent for the Empire District Electric Company.

AN EFFECTIVE METER EXHIBIT.

The mounting of a meter with a glass case and adjacent switches connected with various sizes of incandescent lamps at a conspicuous point in a central-station office for the instruction of the public in the operation and reading of dials is a common practice which has accomplished much good. When such an exhibit is located near the receiving window, where the public pays the periodical lighting bills, there is no question that it often does a great deal toward eliminating the inherent hostility of the public toward the meter as a complicated registering device. An interesting modification of the foregoing plan is in use in the Salt Lake City office of the Utah Light & Railway Company. In place of the usual single meter the company has installed two outfits, each consisting of a glass-incased watt-hour recorder connected with an incandescent lamp of 32-cp rating. One of the lamps is an ordinary carbon bulb and the other is a tungsten unit. The company is making a continuous demonstration of the relative economy of the two types of lamps, having started the two metered circuits in service with the dials at zero on July 21. The lamps are burned continuously and each day an employee of the commercial department reads the two meters and files the corresponding bill at the company's regular rates on the bulletin board above the lamps, calling attention in a printed notice to the fact that the amount of light given out is the same, while the energy consumption of the carbon lamp is approximately three times that of the tungsten. Thus, on Sept. 11 the carbon lamp had consumed 141 kw-hours, at a cost of $15.51, and the tungsten unit had consumed only 51 kw-hours, at a cost of $5.61, the rate being 11 cents per kw-hour. The relative speed of the two meters and the

Double-Meter Exhibit.

posting of the bills each day have aroused considerable interest on the part of persons visiting the office, and the demonstration has done not a little to allay the dislike to meters which so often is manifested by consumers who fail to realize the precision with which registration occurs.

ARGUMENTS FOR CURB LIGHTING.

To point out the advantages to merchants of individual curb-lighting installations the Commonwealth Edison Company, of Chicago, has issued a pamphlet entitled "Well-Lighted Streets Mean More Business." It is pointed out that lamps on ornamental posts spaced uniformly along any business street will increase materially the amount of business transacted there. In many cases well-lighted streets form the only safeguard against failure for the small merchant. The people residing in outlying neighborhoods would prefer to do their shopping in the evening, near home, provided the streets are well lighted and attractive and the merchants carry the goods which are needed. Plenty of light is always inviting, and many times the nearby residents would welcome the opportunity of strolling along the street and looking in the store windows if they were well lighted and attractive. Nearly everyone hesitates to frequent dark and poorly lighted streets, whereas a brilliantly lighted street is an irresistible attraction.

When the merchant can induce people to frequent his street and view his show windows he has a good chance of securing their trade. Another fact noted is that when properly illuminated middle-of-the-block locations are as valuable as corner stores. "When the people of your neighborhood," says the company to the merchant, "see these posts being installed in front of your store they are immediately convinced that you are desirous of making shopping a pleasure to them. It marks you in their minds as a progressive, up-to-date merchant, who has a liberal amount of civic

pride for the district in which he resides and does business."

Where there are local organizations of business men the organization is urged to take the matter up and to telephone to the electric-light company, which will be glad to send a representative to a meeting. If there is no organization the merchants are urged to organize for the good of the street. "Get the movement started and you will be surprised to find the number of merchants who will give their moral and financial aid to make it a success."

The only light that is wholly satisfactory and almost universally adopted for street-lighting purposes is electric light—clean, bright, steady, economical and unaffected by wind and weather. The prices offered by the Commonwealth Edison Company for curb lighting are for street posts supporting four 60-watt tungsten lamps each or one 250-watt lamp, and are as follows:

One post with lamps burning from dusk to 10 p. m. for six nights and from dusk to midnight for one night a week, $1.50 a week.

One post with lamps burning from dusk to 11 p. m. six nights a week and from dusk to midnight one night a week, $1.60 a week.

One post with lamps burning from dusk to midnight seven nights a week, $1.70 a week.

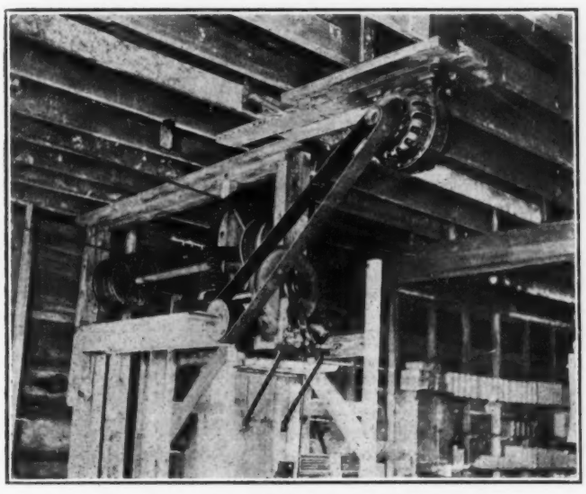
One post with lamps burning from dusk to 1 a. m. seven nights a week, $1.85 a week.

This proposition is made with the understanding that orders are received to install fifty or more posts. The lights are turned on and off by the company at the specified time, and the prices given include wiring, lamp renewals and the maintenance of posts, fixtures and lamps.

MARYVILLE, MO., A SMALL TOWN WITH A LARGE MOTOR LOAD.

Maryville, Mo., is an example of the small community in which an energetic manager has found applications for motors in almost every local industry. Two years ago there was practically no motor service in Maryville. To-day this little town of 6000 population has 275 hp connected.

Not long ago Mr. C. C. Hellmers, manager of the Maryville Electric Light & Power Company, undertook to have motor drive installed in the local laundry. On account of the need of hot water he met the usual discouraging argument that they might as well have the steam anyhow. Finally he succeeded in getting motors installed under the agreement that they should be paid for out of the savings effected. The motors are rapidly paying off their indebtedness and the laundry owner, won over to the better way, is now delighted.



Two-hp, Three-Phase Motor Driving Elevator.

A large local industry is the manufacture of lightning rods, which have a lively sale in farming communities near by. Something as a fire engine is used to fight fire, the lightning-rod factory is equipped with electric drive throughout, motors being used to twist the metallic ribbons into rods, convey material, etc. The accompanying illustration shows a 2-hp, three-phase Westinghouse squirrel-cage motor belted to a worm gear for driving a freight elevator, which is used to lift loads of 3000 lb. through three stories. The application, though crude and rather unusual, is simple and effective. The motor is without a starting device of any kind except a double-throw switch attached to the elevator control rope. The car can be run in either direction by pulling upward or downward on this rope and the motor is often used as a brake by pulling on the reverse rope to stop the elevator suddenly. The severe service which the small motor thus undergoes can be imagined.

Mr. Hellmers has not confined his "power" service campaign to his town limits. Lines from his plant extend to farms 4 or 5 miles in opposite directions, where besides lighting their places the farmers use electric energy for chopping feed, sawing wood, cutting ensilage, pumping, churning, etc.

CENTRAL-STATION METER TESTING IN CHICAGO.

In a paper bearing the significant title "Converting the Company's Product Into Cash" and read by Mr. O. J. Bushnell, superintendent of the meter department, before the Commonwealth Edison Section of the National Electric Light Association in Chicago on Sept. 5, some interesting information was given about the work of the meter department of the Commonwealth Edison Company.

The meter department of this company goes back to 1888. Mr. W. L. Church was the first superintendent, and both Mr. L. A. Ferguson and Mr. John F. Gilchrist were connected with the department in former years. To-day the department has on its payroll 260 employees and its various lines of work are conducted at an annual expense of nearly $200,000. The number of customers' watt-hour meters on the company's circuits has increased rapidly of late years. Ten years ago the number was about 16,000, while now it has reached nearly 160,000, about 27,000 being added annually.

The work of the department is divided along two lines—the maintenance or operating work, which consists of the repair, testing and calibration of meters, and the commercial work, which consists of reading the meters in service and rendering to the auditing department the amounts of electricity to be billed.

All meters when received from the factory are tested on both light and heavy loads, and calibrated if necessary. Alternating-current meters are also tested on an inductive load. The dial ratios and constants of all meters are checked and a thorough inspection made of the mechanical construction. As soon as possible after the meter has been installed an initial inspection is made by a meter-department inspector. Among other things, the inspector checks the accuracy of the meter. In the case of all meters of 15-amp rating or more this check consists of a full instrument test known as the installation test; in the case of meters of 5 amp and 10 amp, a careful examination of the meter is made and the test is by means of a standard 50-watt lamp. If this light-load check on small meters shows any material change in the calibration the meter is reported for a regular instrument test. All meters in service are given periodic tests, the frequency of tests varying according to type, size and use of the meter. In accordance with the established schedule, tests are made as follows:

Direct-current meters of 100 amp and above, every three months; of 25 amp to 75 amp, every six months; of 5 amp to 15 amp, every 12 months. In the last-named class there is a modification of the rule by which meters which exceed a fixed number of revolutions between tests or are in locations affecting their accuracy are tested more frequently than once a year.

Meters of the alternating-current type are tested somewhat less frequently than direct-current meters. Single-phase meters of from 5-amp to 25-amp rating are tested every two years; single-phase meters of 50 amp and above, every six months, and polyphase meters of all ratings, every six months.

Only instruments of a high grade are used in testing customers' meters, and the accuracy of these portable instruments is checked every week by comparison with standard instruments kept in the instrument checking room of the meter department. The stop watches used in testing are also checked daily with a Howard clock, with a seconds pendulum, located in the instrument checking-room. The standard instruments in this room are in turn checked monthly with primary standards in the standard and railway meter-testing laboratory. The equipment of this laboratory includes Weston standard cells with which comparison is made by means of a Leeds & Northrup potentiometer and standard resistances and current shunts. The value of these standards has been certified by the National Bureau of Standards at Washington, and they are rechecked periodically by this government authority. The equipment also includes a full set of Westinghouse precision instruments, a Wolff Wheatstone bridge and other necessary apparatus. A 5-kw motor-generator operated from a sixty-cell storage battery furnishes steady current of any desired frequency or power-factor.

Testing of primary-side or high-voltage meters is carried on in connection with this laboratory, as, on account of the large amounts of energy which are measured by these meters, great accuracy is required. Meters of this class are checked while in service at intervals of from one to three months. If an error exceeding 0.5 of 1 per cent is found the meter is readjusted and must be brought within 0.3 of 1 per cent to be considered correct. The average error found on the monthly tests in the railway power metering during last year was only 0.13 of 1 per cent.

Scarcely any alternating-current meters made previous to the year 1900 are now in use by the Commonwealth Edison Company. The earlier types of direct-current meters have also been discarded; the last of the Edison chemical meters went out of service in September, 1904. Mr. Bushnell believes that the accuracy now obtainable from electric meters compares favorably with that of any other system of mensuration applied to the sale of any kind of commodity. The troubles which may arise in any mechanical device are more likely to cause meters to run slow than fast, so that if an error arises the company rather than the customer is likely to be the loser.

AN ALL-HOUSE SURVEY AND HOUSE-WIRING CAMPAIGN AT DES MOINES, IA.

Des Moines, Ia., with a population of 86,000, is estimated to have 30,000 houses scattered over its unusual area of 56 square miles, a territory larger than that of Boston, Mass. While not all these houses are reached by the lines of the Des Moines Electric Company, the company is carrying on a detailed survey of the entire city, investigating whether each resident uses gas or electricity and the reasons why his house is not connected or wired, if reached by its lines. These records are entered on cards of the form reproduced herewith, fil'ed in by a solicitor who makes a house-to-house canvass of the city by districts. This man first hands the housewife a copy of the Des Moines company's attractive booklet, "The Servant in the House," describing domestic applications of electricity, and then through inquiries secures the data required. This information, he reports, has in every case been very cheer-

Street Center No. 2430

Occupant John Doe ~~Business~~ Residence

~~Agent or~~ Owner Address

HOUSE WIRED	HOUSE PIPED	FIXTURES	REQUIRES	USING GAS FOR	PROBABLE INSTALLATION
OLD Yes ~~NEW~~	Yes	Comb.	~~EXTENSION~~ ~~OR~~ SERVICE	C. + L. USING ELECTRICITY FOR —	12-16 cp

Remarks: Wiring needs repairing before using.

Date 10/12/10 Solicitor B.

Fig. 1—Record Card in Des Moines House-to-House Survey.

fully given. One card relates to each householder, the one reproduced herewith being self-explanatory. The classes "old" and "new" under the "house wired" heading were found necessary on account of some installations failing to pass the present wiring requirements. In the fourth item information is given as to whether the prospect will require an extension of pole line or simply a service drop. One man has been assigned to this work of the house-to-house survey for the last year and has already collected several thousand cards. He can turn in about seventy-five cards

HOUSE WIRING ORDER

Des Moines, Ia., ... 191...

DES MOINES ELECTRIC CO.

Dear Sirs: Please install in the premises at ..... Des Moines, Iowa, of which I am the ....., the following list of wiring, switches, fixtures, etc., necessary for the use of electric light therein, for which I agree to pay $..... upon completion, or as follows: $..... upon completion and $..... upon the .....day of each month thereafter, until fully paid. All payments to be made at the office of the Des Moines Electric Co., 5th and Mulberry Sts.

LOCATION OF ROOM	CEILING OUTLET	SNAP SW.	SIDE WALL OUTLET	3 WAY SW.	LAMPS	FIXTURES (CEILING BRACKET, 1st 2nd)	STORED PRICE
Porch	1	1					3.50
Vestibule							
Hall	1	1					3.00
Living rm	1	1					3.00
Parlor	1	1	2				6.00
Dining rm	1	1					3.00
Bedroom							
Pantry							
Kitchen	1	1					3.75
						Laundry Iron Outlet	1.50
Basement							
3d Floor Hall	1			1			6.25
Bath rm	1	1					3.00
Bedroom			1				3.00
Attic	1	1					3.50
Barn							
							3.00

Total for wiring, fixtures and holophane reflectors .....

Six pound laundry iron .....

Mazda lamps ..... 40w 60w

Carbon lamps (loaned) ..... 4cp ..... 8cp 16cp

Entrance on ..... side. Meter in ..... TOTAL

It is expressly understood and agreed that the title to the material listed above shall not pass from the Des Moines Electric Co. to the undersigned, until the amount agreed above is paid in full, and in default of the payment of said sum when due, the Des Moines Electric Co. is hereby authorized and empowered to remove the above listed material without legal process.

Accepted
Des Moines Electric Co.

By ..... Signed .....
Solicitor Owner

Fig. 2—House-Wiring Estimate and Order Filled Out in Customer's Presence.

per day, making the cost of the survey about 4 cents per card for the solicitor's salary. When received at the office the cards are filed in order in cabinets for reference.

Using this information, a map has been prepared showing in colors the premises of each householder and whether he

is a consumer, has his house wired or is not reached by service. Premises not on the lines are tinted blue with water-color paint. Those wired but not using electricity are colored yellow, while customers are colored green. Should a resident who has had his house wired, but without service, later make application for service it is an easy matter to add a little blue to the yellow already on his plot, converting him to the green shade of the company's customers. This map has been found useful in showing at a glance the company's service in any portion of the city.

While data are not yet available on the entire number of wired and unwired houses in Des Moines, the investigation thus far has shown that in a typical residence section where central-station service reaches 4000 houses 1700 are wired and 1500 are using electricity.

Along with its survey the Des Moines company has been carrying on a campaign to get its old houses wired. The time of three solicitors has been given to this subject. The work is all done by one contractor, who has agreed with the company on a fixed cost of wiring, the elements of which are represented in the accompanying house-wiring order. This rate is equivalent to about $1.50 per outlet, including switches. When flush switches are used 75 cents additional is charged, and 50 cents is added for the longer runs, such as a porch or an attic. The wiring order shown is filled in by the solicitor in the customer's presence and the total cost quoted to him at the first visit. To the items stated $3 plus approximately 5 per cent of the bill is added to cover cost of soliciting, handling, etc. By the wording of the last paragraph on the order sheet failure to pay for the work gives the company a lien on the house.

When the customer has signed the house-wiring contract the items enumerated are copied in triplicate on pink order sheets similarly tabulated. Two of these pink sheets go to the contractor, while a third is filed with the customer's order in the company's office. When the work is completed one of his pink copies is returned by the contractor. This copy is then passed to the bookkeeping department which has charge of accounts, leaving a record of the work in each department interested.

During the five months the campaign has been in progress 149 old houses have been wired, 1136 16-cp equivalents being installed. Forty-two new houses have been wired and ninety-five additions have been made to existing wiring.

Mr. J. L. Bradfield is contract agent for the Des Moines Electric Company.

Wiring and Illumination

GROUNDING SECONDARY NEUTRALS TO WATER-PIPES ON CUSTOMERS' PREMISES.

As a means of securing positive grounds for the neutrals of its secondary three-wire circuits, the Kansas City Electric Company has resorted to the connection of such neutrals, from a point directly where they enter the customers' houses, through No. 4 copper wires soldered to the house water-pipes. At least two neutrals in each block are thus grounded, the intention being that four or more of each secondary circuit will later be thus protected. This grounding assures against any dangerous rise in pressure should the primary voltage become crossed and also prevents troublesome leaks and losses which sometimes occur through a partial secondary ground, to the annoyance of both customer and company. With the dead ground provided the fuses are blown at once, giving notice that the circuit is in trouble.

The work of making these grounds is being done by a special gang, which averages six grounds a day, according to Mr. A. N. Richardson, general superintendent of the company. These men have already installed 1100 grounds, covering at least one-half of the section to be protected. The work is done in the best possible fashion and is made to correspond closely with the existing wiring in the house. Whenever feasible outside construction is used, the No. 4 ground wire being run down and soldered to the sprinkling hose faucet. A good job of soldering can usually be made by emptying the pipe of water, and the use of pipe clamps has been avoided. The average cost of installing the grounds has been $2.05 each .

Grounds to the water pipe are practically perfect electrically and are quite reliable, as the water company does not remove its meters when houses are vacated. Even if piping changes should be made and a given ground disconnected, the other three or four intact connections on the same secondary will protect the house service. In the country surrounding Kansas City the bed rock rises to within a few feet of the surface in places and any driven or buried ground device is, of course, out of the question. The local water company has given its tentative permission for the use of its pipes for this purpose, as such grounding of secondaries to water-pipes has the approval of the American Waterworks Association. A quantity of junked pressure wire which is being taken down in Kansas City will also be used to tie the various secondary neutrals together, thus extending even further the assurance of good grounds for all circuits.

A HOUSE OF ELECTRICAL CONVENIENCES.

The new house being erected for Mrs. Charles K. Towt, of Lindsay, Cal., is to be arranged for lighting, cooking, heating and cooling by electricity. Besides luminous radiators in the fireplaces of several of the apartments, all rooms will be equipped with outlets for heating appliances. In the kitchen both an electric range and a fireless cooker will be provided. The lighting control of this twelve-room house will be notably convenient, the lamps of each room being controlled from three-way and four-way switches at the side of any of the entrances to the room. Similar cross-connections are provided for the stairways, and the porch lighting can be turned on or off from concealed switches operable before starting up the steps. In the basement space is arranged for a motor-driven refrigerating machine for cooling the air in the twelve-room dwelling.

LINE POLE CENSUS STATISTICS.

Preliminary Comparative Report for 1910 Issued by the Census Bureau.

A preliminary statement has been issued by the United States Census Office showing the number of poles purchased by the telephone and telegraph, steam and electric railroad, and electric-light and power companies in the United States during the years 1910, 1909, 1908 and 1907.

Of the 3,870,694 poles purchased during 1910, 2,831,810, or 73.2 per cent, were reported by telephone and telegraph companies; 733,092, or 18.9 per cent, by electric-railway, light and power companies, and 305,792, or 7.9 per cent, by steam railroad companies.

The total number of poles purchased in 1910 by all users of these materials, while greater than the number in 1909 by only 3.5 per cent, exceeded that of 1908 by 19.1 per cent and of 1907 by 17.9 per cent. The steam railroads reported 110,471 more poles purchased in 1910 than in 1909, and the electric railway, light and power companies increased their purchases by 105,678. The number reported by the tele-

phone and telegraph companies, however, was slightly less than in the preceding year, the decrease amounting to 84,195.

In 1910, as in each of the three preceding years, more poles were cut from cedar than from all other woods combined. The proportion contributed by this species, however, has been steadily growing smaller, the percentage of cedar poles in the total of 1910 being 62.8, as against 65.3 in 1909, 67.7 in 1908 and 64.2 in 1907. Undoubtedly cedar leads all other woods in the possession of those qualities most sought after in pole material; hence the increasing proportion of other woods reported during recent years is clearly a logical result of the growing scarcity of cedar timber, together with the consequent advance in its cost. While twenty-eight different woods were reported as drawn upon for pole material during 1910, four species—cedar, chestnut, oak and pine, ranking in the order given—contributed more than 90 per cent of the total during each of the four years covered by the report.

Among the woods used in relatively smaller quantities as pole material a marked decrease is noted in the case of cypress, the number reported from this species in 1910 being only about 75 per cent of that shown for 1907. Principal among the causes of this decrease is, of course, the high and increasing value of this wood as lumber and shingle material. On the other hand, the number of Douglas fir poles has increased rapidly during the four years, the total reported for 1910 being nearly four times as great as that for 1907, while a substantial gain was also made for each of the intervening years.

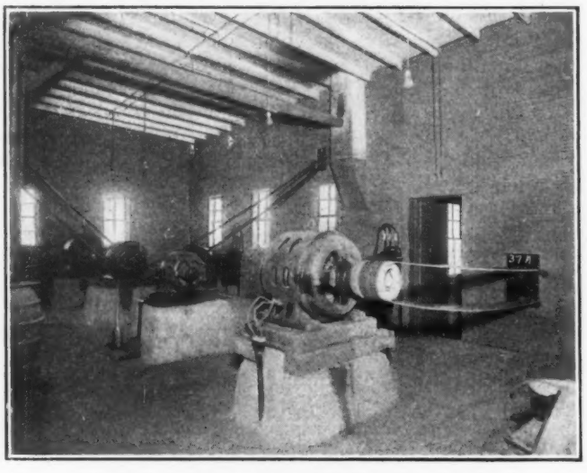
Kind of Wood.	Number of Poles Purchased.			
	1910.	1909.	1908.	1907.
Cedar	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut	677,517	608,066	516,049	630,282
Oak	265,290	236,842	160,702	76,450
Pine	184,677	179,586	116,749	155,960
Cypress	75,459	77,677	90,579	100,368
Douglas fir	56,732	24,877	19,542	15,919
Tamarack	30,964	29,889	24,123	13,884
Redwood	30,421	23,145	13,061	31,469
Osage Orange	23,221	21,491	18,109	5,962
Spruce	22,929	11,423	8,088	10,646
Juniper	20,042	43,581	42,367	38,925
Hemlock	12,773	6,222	1,998	3,301
Locust	9,030	10,463	10,224	4,672
All other	30,072	25,653	27,424	85,953
Total	3,870,694	3,738,694	3,249,154	3,283,268

An interesting fact disclosed by the figures is the rapid growth of the practice of treating poles in order to prolong their period of use. In 1910 824,673 poles, or more than 21 per cent of the total reported purchases for that year, were given some preservative treatment. This number was an increase of 248,042 poles, or 43 per cent, over that of 1909; 480,285, or 139.5 per cent, over that of 1908, and 428,474, or 108.1 per cent, over that of 1907. In 1910 the class of pole users which applied preservatives most extensively was the electric-railway, light and power companies, 29.4 per cent of the reported purchases having been given some treatment of this character, as against 19.9 per cent by steam railroads and 19.4 per cent by telephone and telegraph companies.

MOTOR GROUPING IN ARRANGEMENT OF LEAD-SMELTER DRIVE.

The lead smelter of the Galena Smelting & Refining Company, at Galena, Kan., is one of two smelters in the surrounding Empire lead and zinc zone district driven by electrical energy from the Empire District Electric Company's lines, which operate a number of mines in the vicinity. In this smelter, which produces about 2,000,000 lb. of lead per year, all of the motors driving the various blowers, fans, exhausters, etc., are inclosed in a special motor-room to exclude dust from the machine bearings and parts. As shown in the accompanying illustration, all of these motors are substantially mounted on concrete foundations and each is wired in conduit to its starter on the wall opposite. As is characteristic in the instalations of the Empire District company, all motors of more than 30-hp rating are 2300-volt machines, operated off the primary distribution lines.

The process of smelting lead ore consists in melting the ore in cupola furnaces, the molten lead running off into pigs, while the slag refuse is melted over again in "jumbo"



Motor-Room of Lead Smelter, Galena, Kan.

furnaces for further recovery. The smoke from the furnaces, containing considerable lead oxide, is led through "bag rooms," where in passing out the solid material is deposited in the form of fine dust on the fabric of the numerous bags, 4 ft. wide and 30 ft. long, hung from the ceiling. These bags are then tapped, causing the dust to fall to the floor, where it is gathered up again and subjected to retreatment.

The lead produced by this smelter is of very good quality and finds uses in the electrical arts in the manufacture of storage-battery plates, cables, etc.

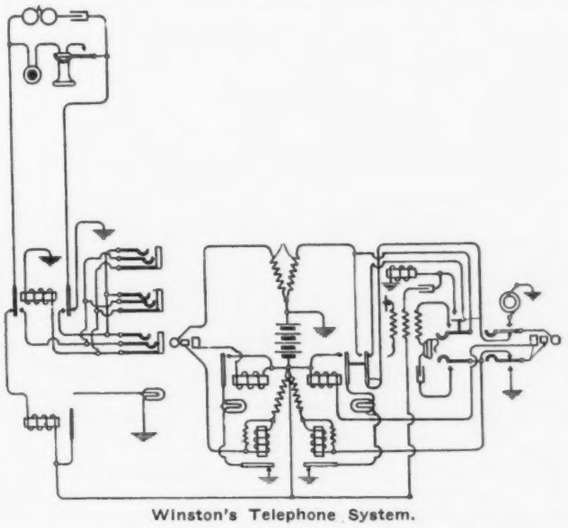
RECENT TELEPHONE PATENTS.

DESK SET.

Mr. A. G. Remhilt, of Philadelphia, is the patentee of a desk set which includes a novel receiver, receiver support and switch device. The receiver polarizing magnet has its axis in a plane parallel to the diaphragm. It therefore is like the old spoon-type receiver, save that it is bipolar. This receiver is hung in a yoke which spans its body, or ear-piece, permitting the receiver to swing slightly about a vertical axis. The other end of the yoke-piece hinges to a short arm, which in turn is secured to the transmitter. The yoke and arm are of such relative length that when swung together the receiver will register with and close the transmitter mouthpiece. At the same time the length is such that when arm and yoke are at right angles the receiver and transmitter are in the relative positions of ear and mouth of a user. Furthermore, the arm may assume a position either to the right or left from the transmitter or may be returned to normal position with the folded arm turned down parallel to the stem of the desk stand. The switch springs are within the arm at the hinge and are driven by cams turning with the yoke-piece.

THREE-WIRE CIRCUIT SYSTEM.

Common-battery switchboard circuits may be classed in two main groups—the three-wire and the two-wire. In the former the multiple-jack circuits carry three conductors each, while in the latter the test conductor is merged with one side of the line and a two-conductor circuit results. There are, however, also other features which may be considered characteristic of the type. Such is the connecting-cord supervisory circuit. In the three-wire system this is



Winston's Telephone System.

generally led through the plug-sleeve and jack-sleeve cut-off relay to ground. On the other hand, in the two-wire system the supervisory-lamp circuit is usually local to the relays of the cord circuit, not being led into the coils at all. Again, in the three-wire system the multiple jacks are usually directly connected to the line circuit, while in the two-wire system this connection is only maintained when the cut-off relay is actuated.

These distinctions are all broken down in a circuit system recently patented by Mr. C. S. Winston, of Chicago. His system is fundamentally three-wire. The cut-off relay controls the jack connection and the supervisory-lamp circuit is not connected through the cords. The accompanying illustration is a diagram of this circuit. The patent is held by the Kellogg Switchboard & Supply Company.

LETTER TO THE EDITOR.

State Control of Public Utilities.

To the Editor of Electrical World:

SIR:—Referring to the editorial comment in the issue of Sept. 23 on the address of Governor McGovern of Wisconsin, delivered at the recent conference of Governors, on the subject "State Control of Public Utilities," and with particular reference to that portion commenting on the limited franchise, it may be of interest to you to know that your statement as to this phase of the public-utility question practically reiterates my own views on this topic, which were, among other features, set forth in a discussion which I recently gave on the increasing cost of operating and the many other obstacles which make difficult the profitable operation of our public-service industries to-day. My discussion, which appeared in the July issue of the New York *Editorial Review*, related specifically to modern systems of urban rapid transit, and I quote below from that portion of my paper in question respecting limited franchises as follows:

"A short-term franchise is another factor adversely affecting the return on the investment, as the expenditure of the large amount of capital necessary for the creation of a high-class city railway system is wholly unjustified if the term of franchise be so brief as not to permit of amortizing the greater part of the investment by provision, from revenue, of suitable sinking funds before the expiration of the franchise. Experience has also demonstrated that for years approaching the expiration of franchise rights the property and service are allowed to deteriorate, much to the inconvenience of the traveling public. Thus it is seen that these disquieting conditions surrounding the operation of public-service properties at present react upon the public itself through the poorer service possible with meager receipts, and this poorer service is also due, in part, to the somewhat reduced efficiency of officers of public utilities, who find it necessary to devote not a small portion of their time to watching and combating adverse legislation, which could otherwise be taken up in the more efficient management of their properties by bettering the service and keeping more in touch with public needs."

Brooklyn, N. Y. CLARENCE P. FOWLER.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Equalizing Connections in Direct-Current Machines.—W. WEILER.—A mathematical discussion of the effect of equalizing connections in direct-current machines. Lack of symmetry in the distribution of the magnetic flux would produce non-uniform load on the brushes and unequal armature reaction on the auxiliary poles. By means of equalizing connections these troubles may be greatly diminished. Rules are given on the number of equalizing connections required.—*Elek. u. Masch.* (Vienna), Aug. 6.

Compound Single-Phase Commutator Motor and Generator.—F. NIETHAMMER, K. SACHS AND E. SIEGEL.—A highly mathematical paper illustrated by numerous diagrams in which they first explain the origin of the compound single-phase commutator motor of the Allgemeine Electricitäts Gesellschaft. It is shown that it may be considered as a combination of the principle of the well-known series motor with cross brushes and of the compensated shunt motor. The theory of both types is given, as well as that of the compound commutator motor and generator, together with results of tests.—*Elek. u. Masch.* (Vienna), Aug. 13 and 20.

Two-Phase to Three-Phase Transformer.—VIDMAR.—An English translation of his German paper recently abstracted in the Digest. The system of transformation described is employed at Weiz, near Graz, for interlinking the old two-phase supply system with a modern three-phase system. The author compares it with the Scott system and thinks that it is an improvement on the latter, both as regards weight and cost and also from the fact that the leakage, and, therefore, the voltage drop, is smaller.—Lond. *Electrician*, Sept. 8.

Belt Leakage.—F. NIETHAMMER AND E. SIEGEL.—A mathematical paper on belt leakage in two-phase and three-phase induction motors.—*Elek. u. Masch.* (Vienna), July 30.

Alternating-Current Machines.—J. LISSNER.—A highly mathematical paper on the theory of alternating-current machines without commutator. The author shows how

certain fundamental differential calculations which he formerly developed can be integrated.—*Elek. u. Masch.* (Vienna), July 30 and Aug. 6.

Commutation and Rotary Converters.—H. S. Hallo.—The author gives the theory of the commutation of single-armature converters with and without interpoles on the basis of Arnold's theory and gives a comparison with that of the direct-current generator and the cascade converter. It is pointed out that interpoles are not especially suitable for single-armature converters, and this is important for the design of machines for high speed, high frequency and high voltage.—*Elek. Zeit.*, Aug. 31.

Heating and Ventilation.—C. Caminati.—The author endeavors to calculate the minimum quantity of air which is necessary for the good ventilation of an electrical machine and applies the method to a numerical instance of a 10,000-kw turbo-alternator.—*La Lumière Elec.*, Aug. 25.

Lamps and Lighting.

Osram Lamps.—H. Remane.—A lecture before the Swiss Electrical Society on the application of the osram lamp in practice. The manufacturers sent inquiries to about 1600 European electricity supply authorities in towns and villages asking whether osram lamps were used for street lighting and what were their candle-powers. One thousand two hundred and ninety replies were received, showing that osrams are employed in 484 localities. The total number in use is 33,643, with a total of 1,640,000 hefner-candles, about 50 per cent of the lamps working on 220 volts. The majority of osram lamps (61.5 per cent) are 50-cp units and very few, actually only 2 per cent of the osrams used in street lighting, are of 16 cp. These are evidently lamps in unimportant streets or emergency lamps. It might have been expected that a large number of 100-cp lamps would be used for street lighting. That this is not the case may be due to several causes, the first and principal one undoubtedly being that the former 16-cp carbon lamps were simply replaced by osrams of the same power consumption so that the lighting system should not be any further loaded up. Secondly, incandescent gas lighting is still predominant in the larger towns. It is well known that in Germany at least many of the smaller towns have for years owned their own gas works and that with the advent of the gas mantle many other gas works were started in very small towns. It is shown that on account of their low specific power consumption osram lamps can be operated at a saving even when carbon-filament lamps are replaced by osrams of double the candle-power. For lighting large squares and streets the osram does not, of course, enter into competition with the carbon-filament lamp, but osrams from 100 cp to 1000 cp compete with small and medium-sized arc lamps. Some data are given on the replacing of arc lamps by large osram lamps in several German railway stations. —Lond. *Electrician*, Sept. 1.

Fluctuations of Temperature and Candle-Power of Alternating-Current Incandescent Lamps.—F. Kesselring.—The author first develops some formulas for calculating the fluctuations of temperature of an alternating-current incandescent lamp during one cycle and especially for calculating the difference between maximum and minimum temperature. These formulas are then applied to four different incandescent lamps, the results being given in Fig. 1. Curve *a* relates to a 230-volt, 32-cp carbon lamp consuming 3.5 watts per candle-power (maximum temperature, 2000 deg. C.). Curve *b* relates to a 230-volt, 32-cp metallic-filament lamp consuming 1.2 watts per candle-power (maximum temperature, 2300 deg. C.). Curve *c* relates to a 145-volt, 25-cp metallic-filament lamp consuming 1.2 watts per candle-power (maximum temperature, 2300 deg. C.). Curve *d* relates to a 25-volt, 25-cp metallic-filament lamp consuming 1.1 watts per candle-power (maximum temperature, 2300 deg. C.). The abscissas represent the frequency in cycles per second, the ordinates the difference between maximum and minimum temperature of the filament. The temperature fluctuations, and, therefore, also the fluctuations in candle-power, are about of the same intensity for low-voltage metallic-filament lamps and for carbon lamps, while they are much larger for high-voltage or standard-

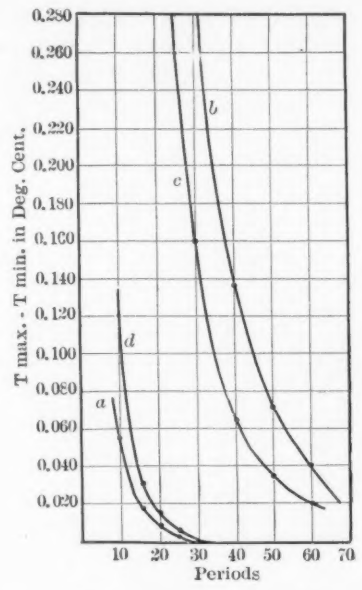


Fig. 1—Fluctuation of Temperature of Alternating-Current Lamps.

voltage metallic-filament lamps. If the current in a low-frequency network (traction current) is used for lighting, it is therefore recommended to use low-voltage metallic-filament lamps.—*Elek. u. Masch.* (Vienna), Aug. 27.

Light Production.—R. A. Houstoun.—The first part of a serial in which the author proposes to deal with the theory of light production, the scope being indicated by the following contents: (1) The distribution of the energy in the spectrum and the measurement of efficiency. (2) The importance of "black-body" radiation and the experimental realization of the black body. Comparison of the energy curves of a black body and of platinum and the variation of the position of maximum energy with temperature. (3) Mechanism of flame, and the temperature, energy and efficiency of flames. (4) The Welsbach mantle and selective radiation. (5) Radiation and efficiency of the carbon incandescent lamp. (6) Physical properties and temperature of the arc. (7) Temperature and energy curves of the Nernst glower. (8) Efficiency of the metallic filament. (9) The mercury arc and its difficulties. (10) The light of the future and the possibility of obtaining "cold light." In the present instalment the spectral energy distribution and the definition of efficiency are discussed.—Lond. *Electrician*, Sept. 8.

Metallic-Filament Lamp.—A note on a recent British patent (23,639, Aug. 31, 1911) of Mr. J. Schilling. Finely divided metal, such as tungsten, is mixed with a quantity of ammonia solution and then kneaded and worked up at the ordinary temperature; or the metal can be exposed to the action of ammonia gas in closed vessels at the ordinary temperature. The product is a plastic mass which can be readily squirted into filaments when the ammonia evaporates on passing a current through, leaving a filament of pure metal.—Lond. *Elec. Eng'ing*, Sept. 7.

Drawn Tungsten Filaments.—A note on a recent British patent (8004, Aug. 31, 1911) of Mr. K. Schwab. The filament is drawn from a tungsten alloy containing non-metallic substances in quantities insufficient to affect the resistance of the wire. Good results are obtained with an alloy of tungsten and a little phosphorus, and nickel can also be added if desired.—Lond. *Elec. Eng'ing*, Sept. 7.

Starting of Mercury Arc.—O. Kruh.—An illustrated paper read before the Vienna Electrical Society giving a

review of the different methods for starting an alternating-current arc.—*Elek. u. Masch.* (Vienna), July 23.

Generation, Transmission and Distribution.

Rural Electrical Supply in Germany.—Notes, with a map, on the rural transmission and distribution system of the Elbtal (Elbe River Valley) power station. The power plant is near Pirna in Saxony and will be equipped with three 4250-volt turbo-alternators. The voltage is 6000 and this is the voltage of transmission by cable through the industrial district between Pirna and Dresden. For distribution of energy to adjoining valleys overhead lines at 20,000 volts are used. The plant is interconnected by a 40,000-volt line with the Hirschfelde power station near Zittan, which contains three steam-turbo sets, two of 2500 hp each and one of 5000 hp.—*Elek. Zeit.*, Sept. 7.

The First 110,000-Volt Transmission System in Europe.—E. G. FISCHINGER.—The conclusion of his long and profusely illustrated article on the 110,000-volt Lauchhammer transmission system. Further details are given of the insulators and poles and other parts of the transmission line, as well as of the equipment of the substations. The plant will be opened in November, 1911.—*Elek. Zeit.*, Aug. 24 and 31.

Installations, Systems and Appliances.

Central-Station Statistics of Austria.—Statistical data on central stations in Austria, the figures referring to the status on July 1, 1911. Statistics are given for only those stations that sell electric energy for public purposes or to private consumers. Isolated plants and traction plants are not included. Stations which buy electricity in bulk from other power plants and sell it to their customers are, however, included. There were 740 stations with an aggregate rating of 378,736 kw (against 675 stations with 318,614 kw in the preceding year). Two hundred and eighty-seven stations were municipal; 453 were owned by private persons or corporations. According to the system used the stations may be subdivided into classes as shown in the first table. Of these stations 332 were operated by water-power, 129 by steam-power, seventy-seven by gas, ninety-two by water and steam, fifty-four by water and gas, nineteen by steam and gas, eleven by steam, water and gas, and twenty-six buy electricity in bulk; 425 stations use overhead wires, twenty-one cables, 216 cables and overhead lines, while no information about this point is available from seventy-eight stations. Of 451 direct-current stations 203 use a two-wire system, 246 a three-wire system and two a five-wire system. The second table gives information on the rate systems in use. Among the stations using a meter rate with discount there are seven stations with a double-rate system.—*Elek. u. Masch.* (Vienna), July 23.

	Number of Stations.	Normal Generators.	Rating in Kilowatts Storage Batteries.	Total Kilowatts
Direct current with batteries	283	50,518	11,128	61,646
Direct current without batteries	170	5,718	....	5,718
Single-phase	13	47,212	.....	47,212
Two-phase	4			
Three-phase	216	135,968	.....	135,968
Combined alternating and direct current	54	111,375	16,754	128,129
Total	740	350,854	27,882	378,736

	NUMBER OF STATIONS.	
	For Lighting.	For Power.
Meter rate without discount	150	138
Meter rate with discount	142	135
lat rate	206	128
Mixed rate (meter and flat rate)	134	94
No information available	108	245
Total	740	740

Prepayment Meters.—GRUBER.—An article advocating strongly the use of prepayment meters for the sake of making electric lighting more popular with the less well-to-do classes of the population. It is recommended that the owner of a at house or tenement house should pay for the electric installation and should get his money back by charging for every room with electric lamps an extra rent of $1 a year. A review is given of the principal prepayment meter designs on the market in Germany. In Lüdenscheid in Germany there was originally a strong opposition to the introduction of prepayment meters, but after the first 200 had been in use for a few months the people changed their mind completely and within two years the number of prepayment meters increased to 700. For all installations of at least two and not more than ten lamps a prepayment meter must be used, while for more than ten lamps a double-rate meter is used, for which a monthly rate is charged. No rent is charged for the prepayment meter, but the price of the kw-hour is 10 cents, while the double-rate consumers pay 10 cents and 5 cents respectively per kw-hour. The system has given satisfactory results for the central station. —*Elek. Zeit.*, Sept. 7.

Italy.—J. REYVAL.—A brief sketch of the development of the electrical industry in Italy since the first central station was opened in Milan in 1883. The dates of the opening of the most important other Italian stations, together with brief notes on their equipment, are given.—*La Lumière Elec.*, Aug. 12.

Charging of Ignition Batteries.—W. E. ROGERS.—An article giving data on the best equipment of central stations for the charging of ignition batteries of gas engines for automobiles.—Lond. *Elec. Rev.*, Sept. 8.

Wires, Wiring and Conduits.

Earth Plate.—An illustrated description of an earth plate (Fig. 2) designed by Mr. J. Bentham for an English colliery installation. The whole of the earth plate and cable terminals is one solid casting weighing 1100 lb. and made of iron 4 ft. 6 in. square to point of teeth and 1¼ in. in thickness. The cable connections are above ground, so that there is no danger of the cable becoming detached from the earth plate through corrosion and, as inspection is easy, constant testing is unnecessary. The cast-iron terminals to take the cables are 9 in. in height from top of plate and 4 in. in diameter, having a hole bored in the center of each terminal 2 in. in diameter and 6 in. deep. The earth plate is fitted with three terminals, one for the 220-kw generator, one for the 550-kw generator and one for the earth cable

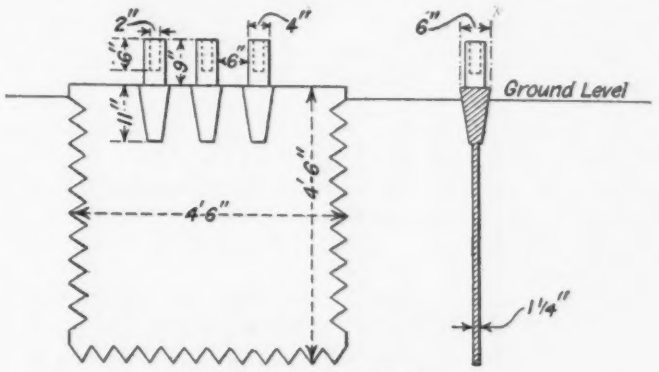


Fig. 2—Earth Plate.

of the mine; it is fixed in a vertical position in the ground in the usual manner, just outside of the power house. The full length of cast-iron terminals remains above ground. It is so arranged that the water from the exhaust pipe of the engine flows constantly to the earth plate, the whole being protected by a small brick cabin with door. The earth plate is also bonded to the water main by means of copper tape ¾ in. wide and ⅛ in. thick, two pieces of this being used. Their ends are put into the cast-iron terminals of the earth plate. In fixing the cables to the earth plate the insulation is taken off for about 8 in. or 9 in. and after the terminals have been made hot by means of blow lamps, etc., the copper cable is pushed down to the bottom of the terminal and then run in solid with white metal. When the terminals are cooled off the bare part of the cables may be finished off with insulation and black varnish.—Lond. *Elec. Eng'ing*, Sept. 7.

Units, Measurements and Instruments.

Reichsanstalt.—Grünbaum.—An account of the work of the German Reichsanstalt in 1910. First an account is given of the co-operation of the Reichsanstalt in the work of the international committee on electric units. The different investigations in the first department relating to mechanics and heat are then briefly sketched. In the electrical division the influence of humidity on the manganine resistors of 1 ohm resistance was investigated, as was also the influence of the silk and of the filter paper on the silver deposit in the silver voltameter. Extended investigations were carried out concerning the radiation loss. In the electrical division of the second department the best arrangement of tests of transformer oils for the determination of the break-down voltage was investigated. Spheres, as well as conical points and needle points, were used as electrodes. With very dry and pure oils the break-down voltage between points is somewhat lower than between spheres. The difference, however, becomes appreciable only for greater distances between the electrodes. With moist oils the break-down voltage was sometimes higher between points than between spheres. In general the values found with points were often irregular. Further preliminary work was done on the absolute determination of the ohm. Other work referred to the reduction of the capacity of large resistors, to energy losses in dielectrics, to energy losses with rapid oscillations. Ammeters for stronger high-frequency currents up to 40 amp were tested for the first time. The experiments on the aging of fuses were supplemented. In the magnetic laboratory improvements of the methods for testing magnetic materials were tried. The influence of the direction of rolling on the saturation value of dynamo sheets seems to be much smaller than the influence on the induction with low field intensities. At Bismarckhütte it was found that the permeability of sheet strips cut at an angle of 45 deg. with the direction of rolling may be sometimes greater than the permeability in the direction parallel to the rolling direction, while heretofore it was assumed that the permeability always decreases if one passed from the direction of rolling over to a direction perpendicular to the direction of rolling. Tests of magnetic circuits with materials of very different properties have given interesting results. In the thermometer department quartz-glass resistance thermometers, platinum thermometers for low temperatures and optical pyrometers were investigated.—*Elek. Zeit.*, Aug. 17.

Reichsanstalt.—A review in abstract of the principal work done by the Reichsanstalt in 1910.—Lond. *Electrician*, Sept. 1.

The Self-Induction of Incandescent Lamps.—M. Höchstädter.—While incandescent lamps are generally assumed to represent non-inductive resistors and are used as such, the author describes some experiments in which carbon-lamps showed a distinct coefficient of self-induction. Carbon lamps for 110-volt normal operation, when used as resistors with 75 volts at their terminals, showed a phase difference of five minutes. With a decrease of the voltage at the terminals the phase difference also decreased and was practically zero at 45 volts. The phenomenon is due to the fact that when a carbon-filament lamp is operated by alternating current its conductance fluctuates with the temperature during a complete cycle, the conductance variations lagging behind the current variations. This results in a distortion of the current wave which, in its effect on the wattmeter, is equivalent to a self-inductance. If this argument is correct it has to be expected that the fluctuations of the conductance would more strongly manifest themselves the lower the frequency. Tests were made with constant voltage (80 volts), while the frequency was varied from 50 periods to 10 periods per second. The results are given in Fig. 3, showing that the apparent self-induction increases rapidly with decreasing frequency. A mathematical theory is given, together with some interesting oscillograph curves. The author shows that metallic-filament lamps should be expected to represent a small negative reactance (a capacity), but this has not yet been tested.—*Elek. u. Masch.* (Vienna), Aug. 20.

Induction Meters.—An official statement of the Reichsanstalt, by which induction meters for polyphase currents and single-phase currents of the Isaria Meter Company are admitted for calibration. Detailed drawings are given of

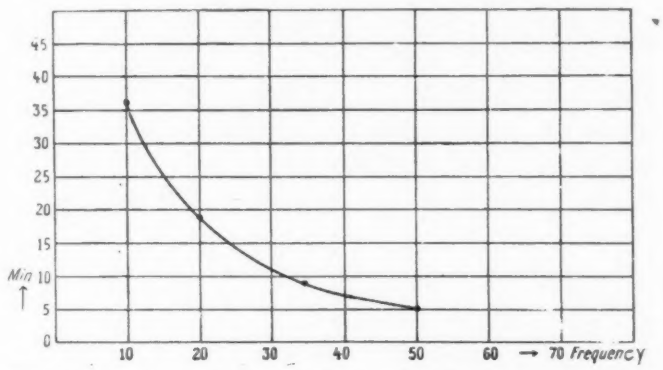


Fig. 3—Variation of Self-Induction with Frequency in Incandescent Lamps.

the designs, and the construction, operation and method of calibration of the meters are described.—*Elek. Zeit.*, Aug. 10.

High-Frequency Generator.—A. Larsen.—An English translation of his German paper recently noticed in the Digest in which a method of generating small high-frequency currents is described, a telephone receiver being connected to a microphone by adjustable air tubes. The frequency can be varied from 600 cycles to 1100 cycles per second.—Lond. *Electrician*, Sept. 1.

Harmonic Analysis.—R. Beattie.—The author describes an extension of Fischer-Hinnen's method of resolving a periodic wave into a Fourier series. Besides the ordinary Fischer-Hinnen 2 *n*-ordinate method he discusses a 4 *n*-ordinate and a combined or 6 *n*-ordinate method. The article is well illustrated.—Lond. *Electrician*, Sept. 8.

Gyroscope Compass.—O. Martienssen.—A paper read before the Berlin Electrical Society on the latest design of the gyroscope compass and its use on board ship and the electrical transmission of the indications of the compass to other parts of the ship.—*Elek. Zeit.*, Aug. 24 and 31.

Electrophysics and Magnetism.

Emission of Electrons from Metals.—J. R. Wright.—The emission of electrons from a metal plate in a vacuum when illuminated by ultra-violet light has been the subject of various investigations. If the electrons emitted under the influence of the light are constituent parts of the atom, which owe their escape to resonance, then the velocities of emission can be determined by measuring the maximum positive charge acquired by a metal when illuminated in a

perfect vacuum. Recently Millikan found that by prolonged illumination with very intense ultra-violet light the positive potentials were increased from ten to thirty times the values previously obtained. The present author has determined the relation between these new positive potentials and the wave-length of the incident light. The positive potential of aluminum was found to increase from 0.25 volt to 14.1 volts as the result of long exposure to very intense ultra-violet light. The relation between this comparatively high positive potential and the wave-length of the incident light has been determined, and it has been found that, contrary to the results obtained by Ladenburg and by Hull, the positive potential reaches a definite maximum for a wave-length of 2166 $\mu\mu$. Using light from different sources is without effect either on the value or the position in the spectrum of the maximum point.—*Phys. Review,* July.

Radiation Pressure.—D. OWEN.—A review of our present knowledge of radiation pressure. The prediction of its existence on theoretical grounds is described and interpretation of radiation pressure is given, showing how the pressure arises in wave propagation, dealing first with light, heat and electrical waves, second with sound waves, and third with transverse waves in an elastic solid. An interpretation from the energy point of view is also given. Finally the most important experimental work on the subject is summed up.—Lond. *Electrician,* Sept. 1.

Conductivity of Copper.—In last year's report of the German Reichsanstalt an account is given of tests of the electric conductivity of various samples of copper. It was found that with a good approximation there exists proportionality between the temperature coefficient and the electric conductivity, so that the product of the temperature coefficient and of the specific resistance in ohms at 15 deg. C. (meaning undoubtedly per centimeter cube) is constant. The mean value of this product for all kinds of copper tested in the Reichsanstalt since 1905 is 0.0000678. The same relation, with other numerical constants, seems to hold good for aluminum and iron. Quite a similar relation has been found by the Bureau of Standards in Washington.—*Elek. Zeit.,* Aug. 17.

Magnetization Curves of Iron.—J. T. MORRIS AND T. H. LANGFORD.—A paper presented before the Physical Society of London, giving an account of an investigation of the differences between the magnetization curves for a given sample of iron when determined by the following methods: (1) Constant rate of change of flux; (2) step-by-step method; (3) method of reversals, and (4) alternating current. The first, or "uniformly varying flux," method appears to possess advantages over the older methods and is recommended by the authors. In Fig. 4 is given a diagram of connections. The voltage induced in the secondary winding S is balanced by the fall of potential over a known resistance r_1, in series with a known resistance r_2, across a cell B, of known emf, equality being indicated by a zero reading on a galvanometer G. The battery B is closed on to the circuit $r_1 r_2$ and simultaneously the primary current is caused to begin to change by means of the rheostat A, and the experimenter has continuously to adjust the rheostat at such a pace as will maintain the galvanometer reading at zero. This adjustment requires some skill, but an average experimenter easily acquires this with a little practice. In making a hysteresis test the primary current is continuously varied from a maximum positive value to an equal negative value by a specially designed resistance in which two sliders a, b, connected to the primary winding P, are moved in opposite directions across the edges of the zigzag resistance A. The primary current is measured on a potentiometer by the voltage drop across a known resistance, r_3, the exact times at which the current has certain convenient values being recorded by a chronographic arrangement. Magnetization curves, permeability curves, reluctivity curves and hysteresis loops determined by all the different methods are given and compared with each other. The authors reach the following conclusions. The method of "uniformly varying flux" appears to possess advantages, both scientific and practical, over the older methods in use for the testing of ring samples of magnetic materials. It avoids difficulties due to eddy currents and magnetic viscosity, which effects are themselves due primarily to rapid or irregular changes of flux. It also has

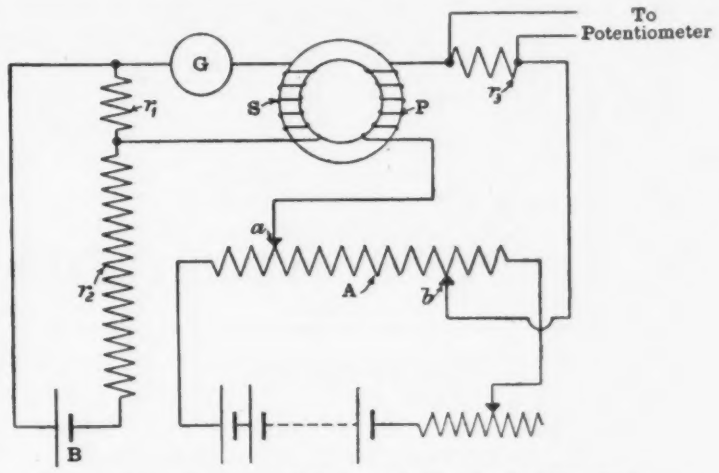


Fig. 4—Connections for Method of Uniformly Varying Flux.

the practical advantage that experiments may be carried out with rapidity, accuracy of repetition and under standard or predetermined conditions of magnetic change. The authors, therefore, commend this method to the careful consideration of those interested in the carrying out of magnetic tests, especially where great accuracy under definitely known conditions of experiment is essential.—Lond. *Electrician,* Aug. 25.

Telegraphy, Telephony and Signals.

Manual and Automatic Telephone Systems.—W. STIEL.—For a number of manual, semi-automatic, and automatic telephone systems the periods of time required for the different steps in making a telephone connection are given from practice, and therefrom different "coefficients of value" are derived for the different systems. The results are summed up in a table which is believed to show the great superiority of the automatic systems over manual systems, but also to emphasize the great difference between different automatic systems.—*Elek. Zeit.,* Aug. 31.

BOOK REVIEWS.

ÜBER DEN KRAFTLINIENVERLAUF IM LUFTRAUM UND IN DEN ZÄHNEN VON DYNAMOANKERN. By Dr. Karl Hoerner. Berlin: Julius Springer. 37 pages, 4 illus., 3 plates. Price, 1.20 marks.

A thesis on a research directed to determine the magnetic flux density in and around the teeth of armature when excited. Of interest to dynamo designers.

LES ENROULEMENTS INDUSTRIE. By Eugène Marec. Paris: Gauthier-Villars. 240 pages, 212 illus. Price, 9 francs.

A very practical and well-illustrated treatise on armature windings for both direct-current and alternating-current machines. Very little attention is given to the theory of the subject, which is taken for granted; but much detail is given concerning the different types of windings, direct current, single-phase, two-phase and three-phase, etc., for armatures. The armature-winding diagrams are remarkably simple. The details of structure and of connection are carefully described.

Anlasser und Regler für Elektrische Motoren und Generatoren. Second edition. By Rudolf Krause. Berlin: Julius Springer. 149 pages, 133 illus. Price, 5 marks.

The second and enlarged edition of a very practical treatise on the theory, construction and mode of operating starters and regulators for generators and motors of various kinds, written by an engineer for engineering students and constructors. The various switching, controlling and protecting devices of dynamo-electric machines in general use are described and illustrated with considerable structural and connectional detail. The book will be appreciated by designers and operators of direct-current and alternating-current machinery.

Electrochimie. By Henri Vigneron. Paris: L. Geisler. 160 pages, 49 illus

This work forms one section (No. 44) of the Encyclopédie Électrotechnique, now in course of publication, and is mainly descriptive of the various electrochemical processes in practical use at the present day. The first section of the volume is theoretical, dealing with electrolytic dissociation, concentration changes, electrolytic conductivities, emfs and electrolytic theories. The second section describes and details the chlorine and alkali industries, the manufacture of hypochlorites, electrometallurgy and miscellaneous products of electrolysis. The third section discusses the industrial production of ozone. The work will be of particular interest to electrochemical engineers.

New Apparatus and Appliances

SIGN PROJECTOR.

The Electric Advertising Company, 32 Union Square, New York, has recently placed on the market a simple device for projecting sign advertisements and trademarks in colors on the sidewalk at night, or the device can also be used for the same purpose indoors during the day, projecting the sign on the floor or wall.

The projector complete weighs 5 lb. and is equipped with a flasher, to make this method of advertising as attractive as possible, and is so arranged that the flashing period can be regulated or set permanently if so desired. The projector

Sign Projector.

body is entirely of brass, neatly finished in gun metal. The device will operate in any position and can be fastened to a bracket wall or suspended from the ceiling. The illuminant is a special wire-drawn tungsten of 100 cp. The projector has three lenses, and when placed in focus projects a powerful spot of light about 4 ft. in diameter, which increases in size to accord with the distance between the front lens and the background upon which the sign is projected.

The slides are 2½ in. in diameter and are made of sheet brass for plain letters, glass being used for trademarks or color effects. The slides are dropped into a slot arranged in one of the tubes. Slides are furnished at a nominal cost, and thus can be changed frequently.

A POLE-PRESERVING MACHINE.

The steadily increasing cost of pole timbers, due to the gradually diminishing supply, has caused all companies using wooden poles for overhead electric circuits to consider methods for increasing the life of these poles. Many preservative treatments have been proposed and tried out to some extent. One method, effective but rather expensive, contemplates the impregnation of the outer layer of the entire pole, or of that portion of it embedded in the ground. Another, using brush or non-pressure treatment, is not so effective but more economical. A new method, using a pole-preserving machine, may be said to occupy a position midway between the other two, and is described herewith.

Careful observation has shown that poles decay almost exclusively at the ground line, where the zone of prolonged exposure to both moisture and air forms a fertile breeding place for germs and insects that destroy the wood cells. It seems logical, therefore, that the portion of the pole near the ground line needs the chief protection. The problem of providing a simple and inexpensive method of applying such a treatment engaged the attention of George P. Benton and I. B. Eberhardt, of Chicago, experienced cedar-pole men, who, after several years of investigation and experimental work, conceived what is known as the "B. & E. pole-preserving machine."

A demonstration of this machine was made on Sept. 20 in the pole yard of one of the largest public-utility corporations of Chicago. Fig. 1 is a view of the machine under test, with a pole in position. About a dozen representatives were present from the United States Forest Service and from several of the leading electric-utility companies of Chicago and other cities. Three 35-ft. Michigan cedar poles cut last winter were treated seven, ten and fifteen minutes respectively with heated creosote oil, which was injected by an air pressure of about 5 lb. per square inch into a 3-ft. band corresponding to the ground belt of the pole. With the ten-minute treatment an initial penetration of 3/16 in. was obtained and this extended in a few days to a depth of over ½ in. The pole in the ten-minute treatment absorbed a full gallon of oil in the 3-ft. band that was subjected to the treatment. The tests showed the simplicity and value of the process.

A fair idea of the machine may be obtained from the accompanying illustrations, and more particularly from Fig. 2, which is a good general view. The machine is about 19 ft. long and 6 ft. wide and is mounted on iron wheels so that it may be easily hauled about by a team of horses to various positions in the pole yard or taken from yard to yard. The main parts of the machine are: A steam boiler, an air compresser and storage tank, a closed oil tank con-

taining steam coils for heating the preserving oil, an air-tight canvas band, 3 ft. wide, which incases the pole at the zone to be treated, and the necessary gearing and mechanism to pass this band about the pole and tighten it. If a large number of poles are to be treated a platform is built

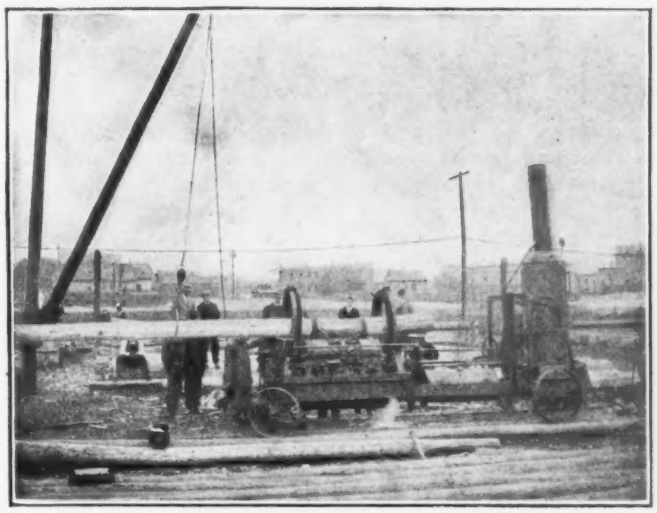


Fig. 1—Pole-Preserving Machine During Tests.

on either side of the machine or the latter is placed in a trench so as to have the iron skids level with the ground; a simpler plan is to place inclined skids on each side of the machine.

The operation of the machine is quite simple. The pole is rolled onto the iron skids. The two segmental rings, which open at the top and are known as track rings, are closed about the pole by turning a hand wheel. The spool carrying the canvas band is then revolved about the pole by an opposite movement of the handle. A clamping bar is wedged against the band so that the latter forms a closed bag or cylinder around the pole. Air pressure is applied to the edges of the band to tighten it and the compressed air is allowed to enter above the oil in the tank, thus forcing the heated oil through a pipe connection into the bag and entirely around the pole for any desired length of time. Any oil oozing out of the bag, as for instance through checks in the pole, drops into a basin on top of the tank,

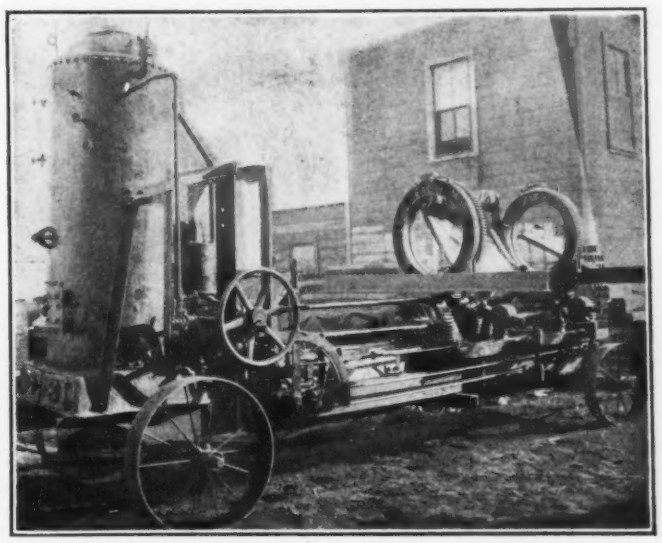


Fig. 2—Pole-Preserving Machine.

into which it is later drained by opening a drip valve. Thus no oil is wasted by spilling on the ground or by treating more than that part of the pole that is subject to decay while in service. By means of the reverse operation the pole is released and then rolled off the other side of the machine, the entire operation taking only a few minutes beyond that required for actually subjecting the pole to the oil. Any kind of coal-tar oil may be used. The capacity of the machine is about fifty poles a day. Poles from 7 in. to 24 in. in diameter may be handled. The cost of treating each pole, which includes labor, oil, fuel and fixed charges on the machine, is said to be only a fraction of a dollar for a 7-in.-top, 35-ft. pole.

This process of pole preservation and the machine for carrying it out are protected by basic patents. The machine is manufactured by the B. & E. Pole-Preserving Machine Company, Fisher Building, Chicago. The company undertakes also to furnish treated poles from Chicago.

ELECTRIC GLUE-HEATING APPLIANCES.

It has been estimated that more than $4,000,000 is paid every year by manufacturers in this country for glue. It has also been asserted by those in position to know that approximately one-half of the glue purchased, or $2,000,000 worth, is wasted yearly. Some of this waste is unavoidable, but much of it can be prevented. A great deal of glue is

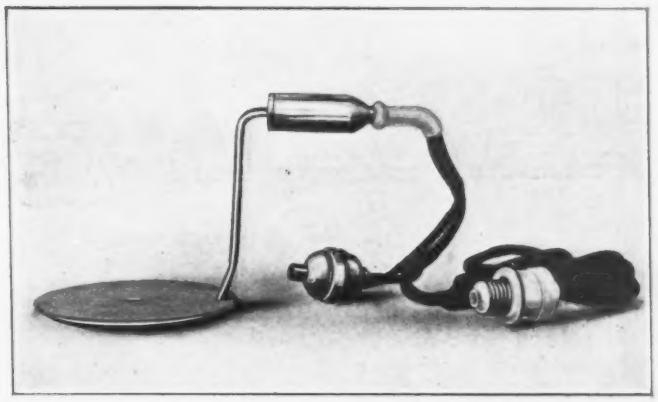


Fig. 1—Disk-Type Immersion Heater for Glue-Pots.

spoiled through overheating. It is well recognized that the proper temperature for melting glue lies somewhere in the neighborhood of 140 deg. Fahr. It is also thoroughly appreciated that, if the temperature of glue is allowed much to exceed 160 deg. Fahr., if it is not rendered wholly unfit for use, its strength will be greatly impaired. An expensive

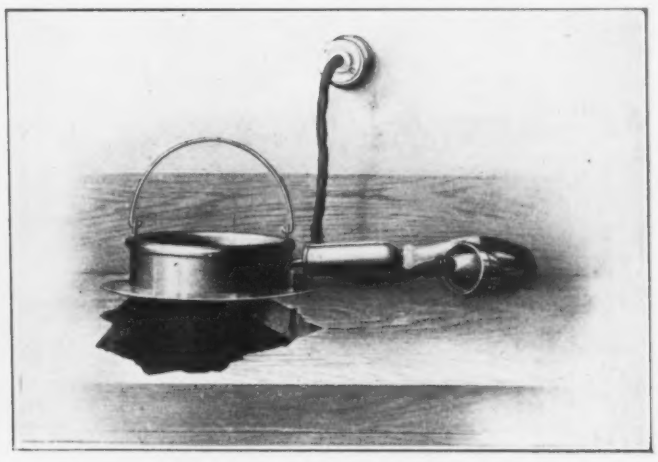


Fig. 2—Exploded View of Portable Glue-Pot.

glue thus abused will be no more effective than a cheap quality. On the other hand, either live or exhaust steam has a temperature (at atmospheric pressure) of at least 212 deg. Fahr.

Electrical methods of glue heating are, when properly

applied, ideal. The ease with which the heat can be controlled, the evenness of the temperature afforded, the readiness with which electricity for glue-pot or heater operation can be conducted to any part of a factory and its economy

Fig. 3—Flush-Type Bench Glue-Pot Installed.

are all convincing recommendations for the electrically heated appliances.

The Westinghouse Electric & Manufacturing Company is manufacturing a line of glue-heating appliances that have

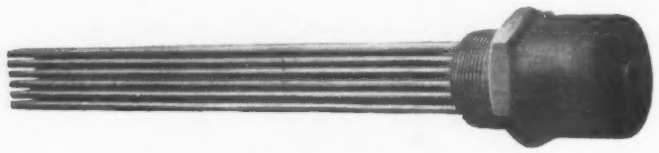


Fig. 4—Bayonet-Type Heater for Glue Cooker.

been designed to incorporate all desirable features and are intended to appeal to practical men through their simple and common-sense design and the fact that they are very ruggedly built to withstand the abuse of industrial-plant service. This line includes portable glue-pots in capacities of ½ pt. to 4 qt.; flush bench-type glue-pots in capacities of 1 pt. to 4 qt., and glue cookers in capacities of 3 gal. to 25 gal. The electrical heaters used in the devices are also

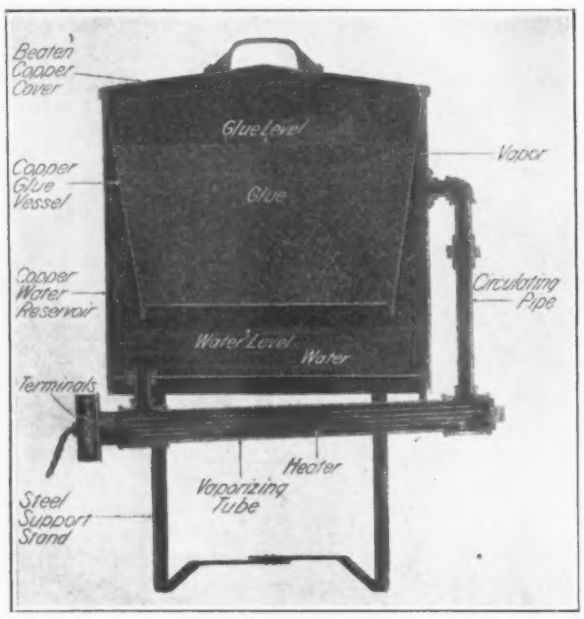


Fig. 5—Sectional View of Electrically Heated Glue Cooker.

supplied separately, so that any manufacturer can fit his present line of glue-heating devices for electrical operation.

All the Westinghouse glue-heating devices are equipped with immersion-type heaters—those which are submerged in the liquid to be heated. Obviously this is the most efficient type of heater for liquids, as no heat can be lost by direct radiation from the heater. Disk-immersion-type heaters, like that shown in Fig. 1, are used in the glue-pots, while bayonet-type immersion heaters, Fig. 4, are used in the glue cookers.

The construction of the portable glue-pots is evident from Figs. 1 and 2. Glue-pots of cast iron, with tinned-iron glue vessels, are made in capacities of ½ pt. and 1 pt., but the regular line has spun-copper glue vessels, it having been found that this is the most satisfactory material for glue receptacles. Substantial bails are provided both on the casings and on the glue vessels. The portable pot is designed for use in any part of a shop where it can be connected to an electric socket.

Flush-bench-type glue-pots are designed for mounting in bench tops or slides, as shown in Fig. 3. A sectional view of a bench-type pot is given in Fig. 4, which shows its construction. Glue vessels and electric heaters are interchangeable for portable and flush-type glue-pots of equal size.

The glue cooker is entirely of heavy copper and will last indefinitely. It will be noted from the sectional view of the glue cooker shown in Fig. 5 that the bayonet-type heater is located in a vaporizing chamber located under the water vessel. Almost immediately after current is turned on water is evaporated and the vapor rising through the circulating pipe enters the space surrounding the glue vessel. Because of this arrangement of the vaporizing equipment the space is filled with vapor in a very short time—long before the entire body of water is heated to the vaporizing temperature. Heating of the glue in minimum time is thus assured. A controller is provided whereby the temperature of the glue can be adjusted to a nicety.

STEEL REFLECTORS.

There are certain conditions in which steel reflectors with aluminum finish are unsuitable on account of deterioration due to acid fumes or excessive dirt or exposure. In order to meet these adverse conditions the Holophane Company has designed a new line of steel reflectors having a tough enamel finish and with the holders and connections of copper. These new reflectors are finished both inside and out with a white enamel, which is stated to have a reflecting value about 18 per cent higher than any other at present available and which is not affected by chemical fumes or by weather conditions and is very easily cleaned. They are made for the extensive type of light distribution only.

Three holding devices are now available for use with Holophane-D'Olier reflectors. The clip spring holder is well known, being the type that has hitherto been supplied exclusively. A new 2¼-in. heel which admits using the steel reflectors with standard holders, and a porcelain socket

Steel Reflector.

holder which allows the use of steel reflectors in many installations where brass sockets are not permissible, are now available also. These holders, as before stated, are copper finished and are of a sturdier construction than those heretofore used.

Industrial and Commercial News

THE WEEK IN TRADE.

INDUSTRIAL conditions are showing gradual improvement, but the absence of steadying influences is still apparent. Gains are being made in many lines of industry, but a stimulus to hasten advancement is needed. Competition and price-cutting have expanded operations this week in the steel trade, and from present indications, September tonnages will equal those of August. Demand for foundry iron is broader, and several sales of fair amounts have been made. Equipment orders from the railroads are still in narrow volume, but inquiries are on an increasing scale, and there is a fair outlook for better business. Dry goods and clothing lines are enlarging, and export demand for cotton goods is showing substantial increase. Sentiment has been improved by news of good weather conditions in the harvesting sections throughout the country, and the forward movement is reflected by better collections at the important centres. Western traffic conditions are improving. Public interest has centered this week upon developments in the affairs of large corporations and the question of their legality under the last rulings of the Sherman law. Attorney-General Wickersham, after approving the reorganization plan of the American Tobacco Company on Monday, issued a carefully phrased statement the same day to express the attitude of the government toward trusts, the substance of which indicated probability of suits against questionable companies in case voluntary dissolution was not made. Owing to the ambiguity of the remarks, business interests found little in them to settle rumors of investigation of the Steel Corporation, and in order to set such rumors at rest, a statement was given out on Tuesday by the United States Steel Corporation, stating that it is not violating the Sherman law and has no intention of voluntary dissolution. Business failures for the week ended September 21, as reported by *Bradstreet's*, were 236, as compared with 219 last week, 190 for the corresponding week in 1910, 171 in 1909, 267 in 1908 and 166 in 1907.

THE COPPER MARKET.

CONTINUATION of dullness in the copper industry has resulted in a decline of ⅛ cent per pound in the price of domestic copper and in a slightly larger reduction in prices abroad. The larger agencies are holding out for 12½ cents, but electrolytic is now selling at 12.20 cents to 12¼ cents per pound, cash, for September and October delivery. Little response to the lower prices is being made, however, by either domestic or foreign consumers, for the majority are finding deliveries on standing contracts sufficient for immediate needs and are placing only very small orders for future requirements. Standard copper in New York is dull and shows signs of further weakness. The record of the month has been exceedingly poor and the September report is not expected to show progress in the industry. Development of industrial unrest abroad has checked the narrow buying movement that followed the last report of the Copper Producers' Association and consumers have not purchased in large amounts at any time during the month. In view of this lack of interest it is believed that total deliveries in September will not exceed 100,000,000 lb., and that after making allowance for slight curtailment at several of the refineries the forthcoming report of the association will show an increase of at least 10,000,000 lb. in surplus stocks. The knowledge that most of the copper now being shipped abroad is upon contracts placed before the slackening in foreign demand took place, and the prospects of large accumulations of stocks in producing hands continue to strengthen the position of consuming interests and lead to the belief that still lower prices may be expected. Amalgamated Copper shares declined 4⅛ points in the break in the stock market on Monday. Exports for the month, including Sept. 26, aggregate 20,531 tons. The daily call on the Metal Exchange Sept. 26 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Price.
Spot	11.80	11.90	....
September	11.80	11.90	11.85
October	11.80	11.90	11.85
November	11.80	11.90	11.85
December	11.80	11.90	11.85

The London market, Sept. 26, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	54 6 3	55 2 6
Standard copper, futures	54 8 9	55 5 0

Extreme fluctuations for this year.

	Highest.	Lowest.
	12.25c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

INDUSTRIAL AND COMMERCIAL NOTES.

Claims Rentals for New York Conduits.—Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity of New York City, has written to Mayor Gaynor stating that many telegraph, fire alarm and electric protective companies are apparently operating without franchises for privileges in city streets. Mr. Thompson finds that the Western Union Telegraph Company has made no payments to the city since 1885. He asks for immediate investigation of the rights of all the companies whose lines occupy space in the public streets, and recommends that those companies which are found not to possess the proper consent or authority to operate should be compelled to make application for franchises and to pay into the city treasury the amount due for the period of time in which they have unlawfully occupied space in the streets. The following nine companies are named specifically by Mr. Thompson: American District Telegraph Company, Holmes Electric Protective Company, Stock Quotation Telegraph Company, Bankers & Brokers' Messenger Company, Automatic Fire Alarm Company, Consolidated Fire Alarm Company, Manhattan Fire Alarm Company, National District Telegraph Company and Special Fire Alarm Electrical Signal Company.

Long Power Transmission.—Advices from San Bernardino, Cal., are to the effect that the Southern Sierra Power Company is preparing to invade the southern California field with its large amount of surplus electrical energy generated at the great power house at Bishop Creek, Imyo County, 300 miles north. It is said that surveyors are now in the field running lines for the high-voltage transmission line to be built across the San Bernardino Mountains and the desert beyond. The company has also secured a blanket franchise to construct pole lines over the highways of San Bernardino and Riverside Counties. A site has been purchased in the western part of San Bernardino for a plant, apparently to be used as a terminal station, although possibly a steam reserve may be also installed. C. M. Scrubby is mentioned as one of the officers of the Southern Sierra Power Company who are active in the work in and near San Bernardino.

Kansas City Railway & Light Company.—Full investigation of street railroad conditions in Kansas City will probably be a result of a petition which the city has filed in the United States Court requesting that either the railroad properties of the Kansas City Railway & Light Company be made suitable for the needs of the city, or the charter of the company be revoked at once. Further complication arises from the fact that the only source available at present by which the receivers of the company can provide finds for satisfying the city's requirements is by withholding bond interest, and if this plan is followed, bondholders can appeal to the courts for their property.

Association of Edison Purchasing Agents.—The regular annual meeting of the Association of Edison Purchasing Agents was held at the New Monmouth Hotel, Spring Lake, N. J., Sept. 21, at which the following officers were elected for the ensuing year: President, J. W. Brennan, Detroit Edison Company; first vice-president, W. H. Francis, Boston Edison Company; second vice-president, J. B. Eaton, Rochester Electric Light Company; treasurer, Andrew Banks, Jr., Consolidated Electric Light & Power Company of Baltimore; secretary, H. F. Frasse, Brooklyn Edison Company; stock controller, E. H. Shufro, Union Electric Light Company, St. Louis, Mo.

Western Electric Business.—Although a slight decrease in gross business has been shown in four of the past five months, Western Electric business in the eight months ended Aug. 30 is about 3 per cent larger than the showing made in the corresponding eight months last year. Gross sales in 1910 were $61,000,000, and from present indications the 1911 record will exceed this, approaching $66,000,000, which would be the largest gross in the history of the company with the exception of that in 1906, which totaled $69,000,000. Comparative figures show that August business was about 3 per cent under that of August, 1910; that July was about 3 per cent less than July of last year, while there was a slight gain in May, and a falling off of about 4 per cent in April, compared with the corresponding months of 1910. Foreign business of the company is running steadily and the present falling off in the domestic business of the company is chiefly from the eastern part of the country. About 26,000 employees are now on the pay rolls, which, with approaching completion of the new plants at Hawthorne, indicates satisfactory progress in the affairs of the company.

Western Union Rates.—President Vail of the Western Union Telegraph Company, discussing rumors of a possible rate controversy as an outcome of the lease of two English cable companies by the Western Union, said recently: "It is singular that the Postal Company should call attention to the danger of a war of cable rates. The Mackay company is a cable system with a land line adjunct for the collection and delivery of cables. Its cable profits are 80 per cent at least of its total net income upon which it depends to pay its dividends on $90,000,000 of stock. The Western Union is a land system with a cable adjunct. Without any cable earnings yet it can take care of the cable obligations out of its surplus and maintain dividends. To talk of a war of rates, however, is out of date. It is too primitive. In all the new services which the Western Union has introduced it will be seen that while the Western Union has been anticipating the needs of the public and developing new lines of business it has been careful not to interfere in any way with the established business or old services."

Public Service Corporation of New Jersey.—Thomas N. McCarter, president of the Public Service Corporation of New Jersey, stated on Wednesday at a hearing by the New Jersey Board of Utilities Commissioners that rates of the company for both gas and electric service will be reduced after Jan. 1, 1912. The rate schedule submitted by the electric company provides for the same schedule of discounts recently adopted by the New York Edison Company. Referring to statements that the company was active in politics, Mr. McCarter said that the company has been active in politics to the extent of self-preservation. "Just as long," he said, "as approximately 10 per cent of the bills introduced into the Legislature at Trenton affect the business of this corporation, just so long will the corporation not only be justified, but required, to defend itself from such attacks by any legitimate means within its power."

Electric Service Extended.—On Sept. 27 forty officials of the Pennsylvania Railroad Company and the Hudson & Manhattan Company made the initial run on the high speed road to be operated by these companies between New York and Manhattan Transfer, where the Pennsylvania road changes from steam to electric locomotives for its through trains. As soon as right-of-way can be obtained the service of the Hudson & Manhattan Company will be extended to Newark. Wilbur Fish, vice-president of the company, stated after the inspection trip that construction work for this extension will require about sixty days. After the line from Manhattan Transfer has been completed to Newark the only part of the system to be built will be an extension in New York City from Thirty-fourth Street to the Grand Central Station. Service will be put in operation Oct. 1 over the portion of the system now completed.

U. S. Lighting & Heating Company Expanding.—Owing to widespread adoption of axle-generating sets by railroads throughout this country, Canada and Mexico, for train-lighting purposes, business of the United States Lighting & Heating Company is showing continual improvement. Control of the Bliss axle lighting devices is held by the United States company, through ownership of the Bliss Electric Car Lighting Company, and the company also controls the National storage batteries by ownership of the National Battery Company. During the month of August these devices were installed in 500 cars, at a cost of $800 to $850 per car, making gross business for the month from this source of $400,000. Part of the expansion of the company's business has been due to increased demand for electric lighting of automobiles and large demand for batteries for electric vehicles.

Westinghouse Railway Orders.—Recent orders received by the Westinghouse Electric & Manufacturing Company include the following: From the Bluestone Traction Company, of Bluefield, W. Va., for one double equipment of No. 101-B-2 motors and type K-10-A control; from the Dayton & Troy Electric Railway Company, Dayton, Ohio, for two type HL control equipments; from the Oakland & Antioch Railway Company, San Francisco, Cal., for four quadruple equipments of No. 321 motors and control, one quadruple equipment of No. 332-E motors and control, and one locomotive equipped with four No. 308-B-6 motors and control; from the Lake Charles Railway, Light & Water Works Company, Lake Charles, La., for two double equipments of No. 92-A motors and K-10-A control.

Otis Elevator Company.—Nearly $30,000 has been distributed voluntarily by the Otis Elevator Company to the families of the victims of the explosion of molten iron at the Yonkers plant of the company last June. Payments in amounts from $3,000 upward have been made to the widows of the four men who lost their lives on this occasion, and their weekly wages will be paid for one year by the company. The doctors' bills and wages of the injured have been paid. As the company was held blameless for the accident, its policy is a noteworthy instance of the attitude now held by leading corporations toward employers' liability.

Canadian Company Buys Equipment.—The Sarnia Gas & Electric Light Company, of Sarnia, Ont., has purchased the following equipment: Boilers, receivers, piping, condensers and a mixed pressure turbine from Goldie, McCulloch Company, of Galt, Ont.; three-phase, 60-cycle generators from Kilmer, Pullen & Burnham, of the Swedish General Electric Company; three exciter sets from the Canadian Westinghouse Company; switchboard from the Canadian General Electric Company; and pumping equipment from the Deane Steam Pump Company, of Holyoke, Mass., and Henry R. Worthington, of New York.

Electric Automobiles for Export.—A report from an American consul in a Latin-American country states that an inquiry has been received from one of the largest importing firms in the city in which he is located, requesting names of the principal manufacturers of electric automobiles in the United States. In order to save time in ordering goods the consul suggests that manufacturers send their price lists and full particulars, as well as catalogs. Further information may be obtained from the Bureau of Manufactures, Washington. The inquiry has the file number 7363.

Proposed Sale of Winnipeg Electrical Properties to Municipality.—At a conference between Sir William MacKenzie and the special committee of the Winnipeg (Man.) City Council on Sept. 23 a basis of audit was agreed to in connection with the proposed purchase by the municipality of the Winnipeg electrical properties. The proposed purchase involves the payment of $24,000,000 to the MacKenzie and Mann interests for the street-railway, light, power and gas plants. The necessary by-law will be at once prepared and submitted to the ratepayers for ratification.

Morris & Somerset Electric Company.—In order to meet the requirements of increased business, the Morris & Somerset Electric Company, of Morristown, N. J., has purchased a 350-hp Babcock & Wilcox boiler; one 750-kw, 2300-volt turbo-generator, and a 25-kw exciter from the Allis-Chalmers Company; a surface condenser and pumps from the C. H. Wheeler Manufacturing Company, of Philadelphia, and a marble switchboard and transformers from the Westinghouse Electric & Manufacturing Company.

Telephone Train Dispatching.—The Toledo & Ohio Central Railroad, which about a month ago adopted the telephone for dispatching trains on its Eastern Division, has recently placed another order with the Western Electric Company for thirty-one telephone selectors for use on its Western Division. This new circuit will extend from Columbus, where the dispatcher will be located, through to the Union Station at Toledo, a distance of 132 miles.

Aluminum Notes and Prices.—The market for aluminum is steady, and quotations on ingots for remelting are 20@22 cents spot No. 1 the base for large ingots. Sheets are held at 33 cents, and rods and wire at 31 cents.

Financial.

THE WEEK IN WALL STREET.

DEMORALIZATION has prevailed on the New York Stock Exchange since Friday last, when widespread rumors of a government suit for dissolution of the Steel Corporation resulted in a sudden break in its preferred and common shares. The latter dropped to 53¼ and the former to 103. Large selling orders in the forenoon of Monday, placed on an irregular market, brought declines of from 2 to 6 points in the prices of a majority of the leading stocks. Steel common fell to 51⅛ and many of the railroad issues made new low records. After a day of great activity partial recovery took place upon news of acceptance of the plan for reorganization of the American Tobacco Company. Total sales for the day amounted to 1,456,196 shares, the largest aggregate since June 30, 1910. A vague statement issued by Attorney-General Wickersham with reference to possibility of more suits under the Sherman law was the basis for still lower prices at the opening on Tuesday, accompanied by indications of further liquidation. While some advances were made, the market was uncertain and wavering throughout the day and the activity not as great as on Monday. Sales were over the million mark, however, amounting to 1,086,263 shares, of which 448,200 shares were Steel common. Tuesday was a large day in the bond market, total sales reaching $7,538,000, of which $5,553,000 were American Tobacco issues. As a result of a favorable statement by officials of the Steel Corporation discrediting rumors of government investigation or voluntary dissolution, a violent upward movement took place on Wednesday. The opening transaction was a sale of a block of 30,000 shares of Steel common, the high quotation being 62. Other issues advanced during the day, but declined toward the close, leaving net prices under those at the opening. The local money market remains unchanged, with no increases in quotations expected until approach of October disbursements. Rates Sept. 27 were: Call, 2⅛@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in the tables are those at the close Sept. 26.

NEW YORK.

	Sept. 19.	Sept. 26.	Shares Sold.		Sept. 19.	Sept. 26.	Shares Sold.
All. Ch.....	6½*	6	200	Int. Met., pf.	40	41	5,000
All. Ch. pf..	18*	16½*	800	Mackay Cos..	82*	83*	125
Amal. Cop...	54	47⅝	213,420	Mackay, C.,pf.	73½	72½	990
Am. D. T....	20½*	20½*	———	Man. Elev...	134½*	131¼*	850
Am. Loco....	34½	33⅛	1,500	Met. St. Ry..	15*	15*	———
Am. Loco. pf.	106½*	104½*	200	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	80½*	80½*	———	Steel com....	65	56⅞	1,973,900
Am. T. & T..	135½	134½	11,440	Steel, pfd....	113⅞	107¼	106,830
B. R. T.....	73¼	73⅜	10,400	W. U. T....	76⅛	77¼	6,017
Gen. Elec....	149	144	9,125	West'h, com.	61	61	6,350
Int. Met.....	14⅛	13¾	12,400	West'h, pf...	111½	110½*	240

PHILADELPHIA.

	Sept. 19.	Sept. 26.		Sept. 19.	Sept. 26.
Am. Rys.....	44	44	Phila. R. T.....	21⅞	21
El. Co. of A.....	11⅝	11⅝*	Phila. Elec.....	16¼	16¼
Elec. St. Bt'y.....	51⅞	50	Phila. Trac.....	82	82*
Elec. St. Bt'y, pf...	30*	30*	Union Trac.....	50	48½

CHICAGO.

	Sept. 19.	Sept. 26.		Sept. 19.	Sept. 26.
Chi. City Ry.....	186*	186*	Com. Edison.....	134½	134
Chi. Elev. Rys.....	24*	24*	Chi. Subways.....	2½*	1⅝
Chi. Elev. Rys., pf..	89½	89½*	Chi. Tel. Co.....	122*	122*
Chi. Rs., Ser. 1.....	92*	92*	Nat'l Car.....	101	101*
Chi. Rs., Ser. 2.....	28½*	27*	Nat'l Car, pf.....	118½*	118½*

BOSTON.

	Sept. 19.	Sept. 26.		Sept. 19.	Sept. 26.
Am. T. & T.....	135½	134½	Mex. Tel.....	6*	6*
Cum. Tel.....	152½*	150½	Mex. Tel., pf.....	6	6*
Edison	286	285	N. E. Tel.....	147½	143¼
Gen. Elec.....	149⅝	144	W. T. & T.....	16¼*	15
Mass. E. Ry.....	17	17*	W. T. & T., pf.....	97*	95
Mass. E. Ry., pf....	88	87½*			

*Last price quoted.
Shares sold for the week, Sept. 18 to Sept. 23.

FINANCIAL NOTES.

American Railways' Year.—The report of the American Railways Company for the year ended June 30, 1911, shows improvement in both gross and net earnings. The surplus after payment of dividends was $40,700, which compares with $11,200 in the previous year and makes the total surplus amount to $554,187. Gross income of the company was $810,413, which represents an increase of $116,735, as compared with the previous year. General expenses were $3,892, taxes were $12,000 and interest on the funded debt amounted to $370,400, making total deductions from income of $387,926. This was an increase of $47,541, and left a net income of $422,487, representing a gain of $69,194 for the year. Dividends were $381,786, leaving a surplus of $40,700 as stated above, an increase of $29,480 over the corresponding item in the previous year. President J. J. Sullivan in his annual report said in part that 18 per cent of the gross earnings were spent in keeping the properties up to the highest standard of maintenance. During the year the company acquired about 99 per cent of the capital stock of the Ohio Valley Electric Railway Company, which owns and operates the street railways in and in proximity to Huntington, W. Va., and Ashland, Ky. This purchase included control of the capital stock of the Consolidated Light & Railway Company, operating in West Virginia towns, the Ashland Electric Light & Power Company and the Ironton Electric Company, which does all the lighting business in the section from Coal Grove to Hanging Rock, Ohio. During the year the company also purchased the electric plant at Bellwood, Blair County, Pa., and consolidated it with the Home Electric Light & Steam Heating Company, of Tyrone, Pa.

San Francisco Gas & Electric Company.—A New York banking house is offering $4,951,000 general first mortgage 4½ per cent thirty-year gold bonds of the San Francisco Gas & Electric Company, which owns and operates gas and electric properties covering the entire city of San Francisco. These bonds are dated Nov. 1, 1903, and are due Nov. 1, 1933, and are part of an issue of $9,500,000 (closed mortgage), which in the opinion of counsel is a first lien on the entire property of the company, subject only to $1,661,000 underlying bonds which are secured by first liens on a comparatively small part of the property, and for the retirement of which an equal amount of the above bonds is reserved. In the company's report to the city its physical property is valued at over $24,000,000, against which there are outstanding only $9,500,000 bonds, the funded debt being less than 40 per cent of this appraised valuation. A strong sinking fund provision, which has already retired $500,000 of the issue, will retire $2,700,000 bonds prior to their maturity in 1933. The gross earnings of the company as officially reported for the year 1910 were $5,534,592, which is over 58 per cent of the bonded debt. There is an equity back of the bonds of more than $14,000,000 on the basis of the purchase price paid for 98½ per cent of the stock of the company by the Pacific Gas & Electric Company. The bonds are offered at 94 and interest.

Tri-City Railway & Light Company.—The August report of the Tri-City Railway & Light Company shows gross earnings of $215,477, which represents an increase of $10,615 as compared with August, 1910. Operating expenses and taxes were $122,793, an increase of $1,129, and net earnings were $92,684, or $9,486 larger than in August of the previous year. Interest and sinking fund charges were $47,661, an increase of $3,536, leaving a balance available for dividends of $45,023. This was $5,950 larger than in August, 1910. Preferred dividends amounted to $14,131 and the surplus for the month was $30,892. In the twelve months ended August, 1911, gross earnings were $2,650,569, an increase of $320,526 over last year's showing. Operating expenses and taxes were $1,546,840, an increase of $203,000, and net earnings were $1,103,729, or $117,526 larger than in the corresponding twelve months of 1910. Interest and sinking fund charges amounted to $559,499, an increase of $28,694, leaving a balance of $548,230 available for dividends, which was $88,832 over last year's figures. Preferred dividends were $169,572 and the surplus for the twelve months was $378,658.

Washington & Rockville Railway Company.—The Maryland Public Service Commission received a letter last week from W. H. Lamar of Rockville, Md., protesting against the approval of the application of the Washington & Rockville Railway Company for permission to give a mortgage deed of trust to secure $100,000 of bonds, and also to increase its capital stock from $50,000 to $300,000, the securities to be delivered to the Washington Railway & Electric Company. Mr. Lamar says the sums mentioned are far above the value of the property and the transaction would convert invalid obligations into valid obligations. He asks a postponement of the hearing in the case, owing to his enforced absence from the State for a couple of weeks.

Brooklyn Rapid Transit Company.—The record of the Brooklyn Rapid Transit Company in the fiscal year ended June 30 was the best in the history of the company. After deduction of all charges there was left a balance available for dividends of more than $3,000,000, which represents 6.82 per cent on the $44,853,772 outstanding stock, as against 5.73 per cent in 1910 and 4.16 per cent in 1909. Gross earnings were $21,986,543, an increase of $1,007,028, or 4.80 per cent, and total expenses were $12,166,367, an increase of $429,256, or 3.66 per cent. Net revenue from operation was $9,820,176, an increase of $577,772, or 6.25 per cent, and other income was $297,524, making a total net income from operation of $10,117,700, which was $596,482, or 6.26 per cent, larger than in the previous year. Deductions from this were $6,969,221, of which $1,465,535 was for taxes and $5,503,686 for interest and rentals. Net income was $3,148,479, an increase of $536,883, or 20.56 per cent, and after deducting from this $88,535 for special appropriations the surplus available for dividends was $3,059,944, representing an increase of 22.25 per cent over the record of the previous year. President Winters in his report stated that arrangements have been completed for providing the $75,000,000 required for the construction and operation of the new subway.

Trenton Street Railway Bonds.—An issue of $300,000 of its general mortgage 6 per cent gold bonds has been sold by the Trenton Street Railway Company to New York banking interests, which are offering them at 101 and interest. The company operates a system of some seventy miles in and about Trenton, N. J., and enjoys unlimited franchises. Net earnings of the company for the first half of the present year indicate substantial improvement over the returns in the corresponding period in the previous year, and it is estimated that earnings for the year will be large enough to leave a balance equal to approximately eight times interest requirements of this issue after all other charges are paid.

Marconi Wireless to Issue Bonds.—At the annual meeting of stockholders of the Marconi Wireless Telegraph Company, Ltd., of Canada, to be held in Montreal Oct. 5, approval of an issue of $2,500,000 thirty-year, first mortgage 6 per cent gold bonds will be asked of the stockholders. The plan provides for the immediate issuance of $1,000,000 of these bonds, the proceeds of which will be used for meeting present indebtedness and furnishing sufficient funds for developing and extending the system and for furnishing additional working capital. The $1,500,000 remaining will be held in the treasury until additional financing is required.

Shawinigan Water & Power Company.—Additional capital stock amounting to $1,000,000 will be issued by the Shawinigan Water & Power Company and will be offered to stockholders at $108, on the basis of one new share for each nine shares now owned. A portion of the proceeds of this issue will be used toward meeting the cost of recent additions to the capacity of the generating equipment of the company. These additions will furnish the capacity necessary for supplying the energy recently contracted for by the Montreal Light, Heat & Power Company.

Mexican Light & Power Company, Ltd.—The combined statement of the Mexican Light & Power Company, Ltd., and the Pachua Light & Power Company, for August, 1911, shows gross earnings (Mexican currency) of $682,494, as compared with $583,337 in 1910, and net earnings of $512,111, as compared with $439,810 in August of last year. Aggregate gross earnings from January 1 were $5,332,894, as compared with $4,392,083 for the corresponding period last year, and net earnings of the two companies amounted to $3,412,217, as against $3,047,632 in the corresponding months of 1910.

Option on American District Telegraph Company Expires.—The option secured in July by F. M. Delano, of Detroit, on the stock of the American District Telegraph Company of Brooklyn has expired, due to delay in taking it up caused by illness of the promoter. It is possible that the matter will be taken up again by the Detroit interests later in the year. The record of the company shows that it was organized in 1872, under the general law of 1844, which gave it the right to transact business and to string wires in any part of New York State.

Toronto Street Railway Company.—The report of the Toronto Street Railway Company for August of this year was the most favorable in the history of the company. Gross earnings for the month were $428,960, as compared with $386,805 in August, 1910. Gross revenues of the company have shown marked improvement in the past few years, as is shown by the fact that the percentage of August earnings paid to the city this year, amounting to $85,792, is almost double that paid in 1906. That the affairs of the company are regarded as in very satisfactory condition is shown by the recent increase in dividend rate from 7 per cent to 8 per cent.

Virginia Railway & Power Company.—It is expected that action will be taken shortly relative to a dividend on the common stock of the Virginia Railway & Power Company. During July and August the surplus of the company was $150,000, which is at the rate of $900,000 for the year. In case the scale of July and August earnings is maintained, after deducting $400,000 for the preferred dividend of 5 per cent, $500,000 would be left for dividends on the $12,000,000 common stock.

Canadian Bell Telephone Company.—An increase in capital stock from $12,000,000 to $15,000,000 will be made by the Canadian Bell Telephone Company, and the additional amount will be offered to stockholders of record at par at the rate of one share of the new stock to five owned. The company has just opened its line from Montreal to Fort William, Ont., a distance of 995 miles. This is the longest telephone line in Canada.

United Missouri River Power Company.—At a public auction to be held at 31 Nassau Street, New York City, on Nov. 8, the New York Trust Company as trustee will sell $2,781,500 first and refunding gold bonds of the United Missouri River Power Company, which represent collateral security for $1,850,000 6 per cent gold notes of the company. These matured July 1, 1911, and payment was defaulted.

Sao Paulo Tramway, Light & Power Company.—It is announced that the Sao Paulo Tramway, Light & Power Company has arranged to dispose of £150,000 additional perpetual consolidated debenture stock.

Wagner Electric Increases Capital Stock.—Advices from St. Louis state that the Wagner Electric Manufacturing Company, of St. Louis, has increased its capital stock from $1,200,000 to $1,500,000.

DIVIDENDS.

American Gas and Electric Company, quarterly, preferred, 1½ per cent, payable Nov. 1; common, 1½ per cent, payable Oct. 2.

American Power & Light Company, quarterly, preferred, 1½ per cent, payable Oct. 2.

Bell Telephone Company of Missouri, quarterly, 1 per cent, payable Oct. 2.

Electric Storage Battery Company, quarterly, preferred and common, 1 per cent, payable Oct. 2.

Electrical Utilities Corporation, quarterly, preferred, 1¼ per cent, payable Oct. 16.

Kansas Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 2.

Mexican Telegraph Company, quarterly, 2½ per cent, payable Oct. 14.

New England Telephone & Telegraph Company, quarterly, 1¾ per cent, payable Sept. 30.

Otis Elevator Company, quarterly, preferred, 1½ per cent; common, 1 per cent, both payable Oct. 16.

Philadelphia Company, quarterly, 1½ per cent, payable Oct. 2.

REPORTS OF EARNINGS.

KEYSTONE TELEPHONE COMPANY OF PHILADELPHIA.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
August, 1911.....	$96,928	$49,247	$47,681	$25,073	$22,608
August, 1910.....	93,966	47,206	46,790	24,267	22,523

MONTREAL STREET RAILWAY COMPANY.

August, 1911.....	$443,108	$232,529	$210,578	$73,633	$136,945
August, 1910.....	398,828	216,314	182,514	65,743	116,771

NORTHERN OHIO TRACTION COMPANY.

August, 1911.....	$272,624	$143,666	$128,958	$44,321	$84,637
August, 1910.....	263,149	135,833	127,316	43,496	83,820

RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY.

August, 1911.....	$1,149,851	$530,173	$619,678	.....	.....
August, 1910.....	1,027,931	495,829	532,102	.....	.....

SAO PAULO TRAMWAY, LIGHT & POWER COMPANY.

August, 1911.....	$303,796	$114,037	$189,759	.....	.....
August, 1910.....	258,704	93,370	165,335	.....	.....

General News

Construction News.

ASHVILLE, ALA.—The Ashville Cooperage Company, it is reported, is contemplating the installation of an electric-light plant.

ELBA, ALA.—The Pea River Power Company has awarded contracts for the construction of a new power plant to cost about $150,000. The work will include a 25-ft. dam and power house. The plant will be located in Coffee County. The company supplies electrical service in Troy, Dothan and several other cities. Charles Henderson, of Troy, Ala., is in charge of the plant.

TROY, ALA.—The city of Troy has contracted with the Pea River Power, of Elba, Ala., to supply electrical energy to operate the municipal electric-light system. Electricity will be distributed through the municipal system as at present.

PHOENIX, ARIZ.—Bids will be received until Oct. 10 for the construction of the south side power station for the Salt River Valley Water Users' Association. The power house will be of reinforced concrete construction, 40 ft. x 60 ft. The plant will have an output of 3000 hp. C. A. Van der Veer is secretary.

HARRISON, ARK.—The Harrison Electric Light & Ice Company is extending its system to East Harrison to provide residents of that section with electrical service.

PARAGOULD, ARK.—Improvements and extensions are being made to the electric plant of the Crystal Ice Company, involving an expenditure of about $30,000. The company has established a day service and is equipping its plant to provide for the increased service. Contracts have been placed by the company for a 150-hp Corliss engine and a 150-kw generator, at a cost of $15,000.

BAKERSFIELD, CAL.—Plans have been completed by the Pacific Telephone & Telegraph Company for the erection of its new telephone exchange building on Twentieth Street, the cost of which is estimated at about $80,000.

CALEXICO, CAL.—The installation of a municipal electric-light plant in Calexico is under consideration. A committee has been appointed to make investigations and secure estimates of cost of same.

CORNING, CAL.—The Sacramento Valley Power Company is extending its transmission lines into the Fountain Finnell ranch, which was recently purchased by Louis Titus. The owners propose to develop water from the wells and use pumping plants. M. J. Barnet, of Fresno, Cal., will have charge of the ranch.

DORRIS, CAL.—The Siskiyou Electric Power & Light Company, of Yreka, Cal., has applied to the Town Trustees for a fifty-year franchise to install and operate an electric system in Dorris.

FRESNO, CAL.—Preparations are being made by the San Joaquin Light & Power Company for the erection of a transmission line from Madera to Gustine, work on which will begin in the near future.

FRESNO, CAL.—Preparations are being made by the San Joaquin Light & Power Company for a large hydroelectric power development in the Big Creek basin, work on which will begin early next spring. The project will include the construction of three large dams and a power plant. The proposed system will be larger than the plant recently completed at Crane Valley.

LOS ANGELES, CAL.—Plans are being prepared by the Police Department to install a signal-light system in the Highland Park and Garvanza districts. Residents of the section will defray part of the expense.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation is reported to be considering an issue of bonds to the amount of $2,500,000 to provide funds for extensions and improvements to its system. C. A. Henderson is secretary and treasurer.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has been granted a franchise by the County Supervisors to construct an electric railway from Schuetzen Park to a connection with the present South Pasadena system, work on construction of which will begin at once.

MARYSVILLE, CAL.—The Chamber of Commerce has appointed a committee to secure funds for the erection of electric-light arches on D Street. The cost of the system is estimated at about $4,000. It is also proposed to install the system on other streets.

OAKLAND, CAL.—The Oakland & Antioch Electric Railway Company has awarded a contract for the construction of its proposed railway from Oakland to Walnut Creek to the Shattuck-Edinger Company.

PASADENA, CAL.—The City Council has authorized Mayor Thum to enter into negotiations with J. T. Harris, of Santa Monica, Cal., for the erection of an experimental plant at the city farm for the disposal of garbage by electricity. The city will have an option on the plant with the privilege of purchasing it within forty days after its installation. The tentative contract submitted to the Council provides for the construction, at Mr. Harris's expense, of a unit with a reducing capacity of 500,000 gallons daily. It is to be equipped with electrical and magnetic appliances and operated thirty days free of expense, the city agreeing to install pipe connections with the sewer system and to furnish electricity free of charge. After that period the city reserves the right to purchase or reject the plant within ten days. The entire cost of the experimental plant is not to exceed $5,000.

PETALUMA, CAL.—The Pacific Gas & Electric Company is planning to extend its transmission lines from Petaluma to Penngrove and also from this city to Mountain Avenue district and through the Sunny Slope district.

QUINCY, CAL.—Plans are being considered for the construction of an electric railway to extend from Indian Falls, near Quincy, to a junction with the Western Pacific Railroad in Indian Valley. G. H. Goodhue, of Indian Falls, is interested in the project.

RIVERSIDE, CAL.—The extension of the street-lighting system on Orange Street from First to Sixth Street is being considered by the Board of Utilities. The cost of the work is estimated at $1,370.

SACRAMENTO, CAL.—The Citizens' Light & Power Company, of Sacramento, Cal., is reported to have been absorbed by the Great Western Power Company. The company was recently organized by a number of local capitalists and has secured large contracts to supply electricity for lamps and motors, which, it is said, have been turned over to the Great Western Power Company. The present arrangements indicate that the substation of the Great Western Power Company at Eighth and R Streets will be the distributing center in Sacramento.

SALINAS, CAL.—The Board of Supervisors has granted F. G. Baum, representing the Monterey Gas & Electric Company, a franchise to erect transmission lines over the county roads in the Salinas Valley. The price for the franchise was $200.

SAN DIEGO, CAL.—The City Council has adopted a resolution to install an improved arc-lamp lighting system on Fifth street.

SAN FRANCISCO, CAL.—F. G. Baum & Company, engineers, have been granted a franchise to erect a transmission system through Monterey County. An extension of about 70 miles will be made to the present lines.

SAN FRANCISCO, CAL.—The Secretary of Agriculture has canceled the Nevada-California Power Company's pipe-line permit on Bishop Creek, in the Inyo Forest, and has ordered the San Francisco Forest Supervisor to investigate the company's reservoir permit.

SAN FRANCISCO, CAL.—The Placer Electric Company, recently incorporated, is reported to have purchased the holdings of J. J. Bryson on the north fork of the American River in Placer County. It is understood that the company will acquire other water rights and electric power properties in that neighborhood.

SAN JOSE, CAL.—Application has been made to the Board of Supervisors by C. P. Andrews for an electric railway from San Jose to New Almaden, a distance of about 11 miles.

SAN JOSE, CAL.—The Board of Supervisors has granted the petition of the Great Western Power Company for a franchise for the erection of an electric transmission line throughout the county, bids for which will be received until Nov. 6.

SANTA ANA, CAL.—The Board of Trustees has entered into a contract with the Southern California Edison Company to supply energy at 8 cents per kw-hour. The company agrees to discontinue its injunction suit to restrain the city from enforcing a 7-cent rate.

SUSANVILLE, CAL.—The Board of Trustees has granted a franchise to erect and maintain transmission lines for the distribution of electricity within the corporation of Susanville.

SUTTER CITY, CAL.—The Pacific Gas & Electric Company is planning to erect a substation in Sutter City to supply this district with electricity for lamps. Work will soon begin on construction of same.

WEAVERVILLE, CAL.—The Board of Supervisors has granted the Trinity Dredging Company a franchise to erect and maintain electric transmission lines over the county roads near Lewiston for a term of fifty years. The amount paid for the franchise was $144.

WHEATLAND, CAL.—The Pacific Gas & Electric Company has commenced work on the construction of a transmission line from Wheatland to the Huntington tract, a distance of 4 miles. The company will supply electricity for irrigation work.

WILLOWS, CAL.—The Northern California Power Company is contemplating extending its transmission lines to Arbuckle.

WALLINGFORD, CONN.—The Board of Electrical Commissioners has rejected all bids submitted for the construction of the addition to the electric-light plant, all proposals being too high.

TAKOMA PARK, D. C.—The Town Council has authorized Mayor W. G. Pratt to enter into a contract with the Potomac Electric Power Company, of Washington, D. C., for lighting the streets of the town. Incandescent lamps of 40 cp will be used. The contract will amount to $1,500 annually. At present the town is lighted with oil lamps.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Oct. 21 for lighting fixtures for the United States buildings at Brookhaven, Miss.; Lexington, N. C.; Milledgeville, Ga.; Mount Sterling, Ky.; Waxahachie, Tex.; Waycross, Ga.; Big Stone Gap, Va.; Shreveport, La., and Port Arthur, Tex., in accordance with drawings and specification, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

JACKSONVILLE, FLA.—Sealed bids will be received by the Board of Trustees for Water Works and Improvement Bonds, Jacksonville, Fla., until Oct. 4 for furnishing the following: For 1000 galvanized crossarm braces and bolts, 900 galvanized ground wire arms and bolts, 1000 galvanized crossarm iron and bolts, 1000 galvanized pole steps, 200 galvanized guy rods, 116,000 ft. 750,000 circ. mil, bare copper cable, 20,000 ft. No. 2 bare copper ground wire, 50,000 ft. ⅜-in., 11,500 lb. galvanized guy wire, 45,000 ft. No. 12 copper rubber and weatherproof twisted pair telephone wire, 12,000 ft. 400,000 circ. mil, three-conductor varnished cambric armored cable with junction boxes and potheads, 200 high-tension porcelain insulators, 500 porcelain strain insulators and 2000 separate thimble iron insulator pins. Plans and specifications may be seen at the office of the board and at the office of the Scofield Engineering Company, Arcade Building, Philadelphia, Pa. W. M. Bostwick is chairman of board.

ATLANTA, GA.—The Buckhead Improvement Company has applied for a charter for the purpose of securing general improvements to real estate in Buckhead and vicinity, and the installation of electric-light and power plants, water-works, sewerage and gas plants. R. F. Maddox, L. C. Hopkins, J. L. Ridley and others are interested in the company.

ATLANTA, GA.—The Atlanta Northeastern Railway Company, which proposes to build an electric railway from Atlanta through Roswell into northeast Georgia, has filed amendments to its charter so as to extend the railway from Midway, in Forsyth County, to Creighton, in Cherokee County, and also to increase its capital stock from $50,000 to $1,200,000. J. M. Penderis, president, and J. L. Murphy, vice-president.

CLARKSVILLE, GA.—The installation of an electric-light plant and water-works system in Clarksville is reported to be under consideration. John Martin is said to be interested in the project.

DOERUM, GA.—The city of Doerum is reported to have awarded the contract to install an electric-light system to J. B. McCrary & Company, of Atlanta, Ga., to cost about $7,000.

ELK CITY, IDAHO.—Plans are being considered by the Welch Tunnel Gold Mining Company for the construction of a hydroelectric plant to supply electricity for operating its mines. R. K. Welch is general manager.

SILVER CITY, IDAHO.—The Swan Falls Power Company is contemplating the erection of a new transmission line from Rich Gulch to Flint, a distance of about 7 miles.

BEECHER, ILL.—The Village Board has granted a franchise to the Beecher Light & Power Company to install and operate an electric-light plant in Beecher.

BELVIDERE, ILL.—Franchises have been granted by the City Council to the Belvidere City Railway Company and the Elgin & Belvidere Electric Company to construct and operate electric railways on the streets of the city for a period of twenty years. The city line will be allowed to carry passengers only and is forbidden to use steam or third-rail system. The Elgin & Belvidere Electric Company is given the privilege to furnish passenger, freight and mail service, subject to restrictions.

CHAMPAIGN, ILL.—The Illinois Traction Company is reported to have entered into a contract with the Illinois Central Railroad Company to supply electricity for lamps and motors for the new shops of the railroad company near this city.

CHESTER, ILL.—The City Council, it is reported, is making investigations with a view of purchasing the local electric-light plant to be owned and operated by the municipality.

DU QUOIN, ILL.—The Du Quoin Utility Company is planning to install new electric arc lamps on the streets, at a cost of about $3,500.

FITHIAN, ILL.—The Village Board is considering the question of installing an electric-light plant in Fithian.

MANHATTAN, ILL.—The Board of Trustees has granted the Economy Light & Power Company, of Joliet, Ill., a fifty-year franchise in Manhattan and a ten-year contract for street lighting, under the terms of which the company is to furnish twenty-seven tungsten cluster lamps at $44 each per year. Provision is also made that electricity is to be furnished to private consumers at the same rate as paid in Joliet.

OGDEN, ILL.—The Village Board is contemplating the installation of an electric-light system in Ogden. Negotiations are under way with the Illinois Traction System with a view of securing electricity from that source.

PAXTON, ILL.—The citizens have voted to issue bonds to the amount of $17,000, the proceeds to be used to install a municipal electric light and power plant to supply electricity to light the streets and to operate the pumping station in connection with the water-works system.

CONNERSVILLE, IND.—The Commercial Club is interested in a project to build an electric railway to Rosedale and other suburbs north of Connersville.

MADISON, IND.—The plant and holdings of the Madison Light & Railway Company have been purchased by the Cincinnati & Madison Traction Company. It is said that the transfer of the property means the early construction of the proposed electric railway from Madison to Scottsburg. It is understood that improvements will be made to the lighting system.

SOUTH BEND, IND.—An order has been placed by the Indiana & Michigan Electric Company with the Rochester Bridge Works, of Rochester, Ind., for structural steel for its new power plant, amounting to $40,000.

VINCENNES, IND.—Bids will be received by the Brindley Company, 17 Battery Place, New York, N. Y., until Oct. 15 for work on the Vincennes, Washington & Eastern Traction Company's interurban electric railway in southern Indiana, 36 miles in length, as follows: For about 250,000 yards of excavation, laying 6-in. x 8-in. x 8-ft. ties, 2-ft. centers and 60-lb. rails; gravel ballasting from 6 in. below ties (gravel obtained locally); about 400 tons of structural steel for bridges; concrete piers and abutments for the above bridges; furnishing 100,000 ties 6-in. x 8-in. x 8 ft. and 2000 7-in. x 13-in. x 35 ft. poles.

ALBIA, IA.—A committee, consisting of L. T. Richmond, J. E. Loeb and J. M. Gass, has been appointed to look into the question of securing electrical energy from the proposed hydroelectric plant at the Keokuk dam.

BOYDEN, IA.—Plans are being made by Veenschoten Brothers for the installation of an electric light plant and auto garage in Boyden, Ia.

DES MOINES, IA.—The contract for ornamental lamp standards for cluster lamps on West Seventh Street has been awarded to the McDonnell Iron Works, of Des Moines, Ia.

KEOKUK, IA.—The War Department is reported to have approved detailed plans for the construction of the large lock to be built by the Mississippi River Power Company at Keokuk. The lock will be 400 ft. long by 110 ft. wide and will have a 40-ft. lift in low water. Hugh L. Cooper is consulting engineer.

REDFIELD, IA.—The installation of a municipal electric-light plant and water-works system is under consideration, for which bonds to the amount of $15,000 have been voted.

CHANUTE, KAN.—A proposition has been submitted to the City Council offering to supply electricity at 2 cents per kw-hour in Chanute by W. E. Reynolds, of Erie, Kan., and C. D. Reynolds, of Chanute. The plan includes the erection of a hydroelectric plant on the Neosho River at Austin, 5 miles from Chanute, where they have purchabsed a dam built many years ago to supply power to operate a flour mill, which was destroyed by fire. A site has also been purchased a short distance from the dam on which it is proposed to erect a large flouring and alfalfa mill. The city owns a municipal electric plant, which was constructed ten years ago, which is now inadequate to meet the demands made upon it.

CHAPMAN, KAN.—At an election held Sept. 14 the proposition to issue bonds to the amount of $25,000 to provide for funds for the installation of an electric light plant was carried.

FT. LEAVENWORTH, KAN.—Sealed bids will be received at the office of quartermaster until Oct. 25 for furnishing cable and electrical supplies as follows: 950 ft. lead sheet cable, 500,000 circ. mil; 450 ft. 250,000 circ. mil, two circuit breakers, six inclosed fuses, thirty wall insulator hangers, 100 porcelain insulators, thirty clamp hangers, three knife switches, twelve wrought-copper terminals and one recording wattmeter. W. Van Duyne is quartermaster.

GLASCO, KAN.—The City Council has authorized the Mayor to enter into a contract with the Concordia Electric Light Company for rebuilding the transmission line between Glasco and Concordia. The Concordia company will rebuild the line to carry 33,000 volts and furnish equipment, including transformers, insulators, etc., and will furnish electricity at the switchboard in Glasco. Under the new contract the company will assume the cost of rebuilding the line and the entire cost of maintenance of same.

KANSAS CITY, KAN.—The contract for the construction of the power station and boiler house for the proposed municipal electric light plant has been awarded to the J. W. Ferguson Construction Company, for $23,669; the contract for the construction of the foundations for the two buildings was let to the Alpine Construction Company for $9,984.

KANSAS CITY, KAN.—Sealed bids will be received at the Council Chamber, City Hall, Kansas City, Kan., until Oct. 3, for furnishing and installing steam turbines, generators and induction motor-exciter, driven units upon foundations furnished by the city in the municipal electric-light plant at Quindaro, Kan., and for switchboard plant at Quindaro. Also for furnishing 450 arc lamps and necessary equipment for same.

SOUTH HAVEN, KAN.—At a special election held recently bonds were voted for the installation of a municipal electric-light plant and water-works system.

HICKMAN, KY.—The Kentucky Southwestern Railway, Electric Light & Power Company, which proposes to build an electric interurban railway from Paducah toward Mayfield, Union City, Clinton and Hickman, will also construct a belt line to run from near Milburn to Lovelaceville, thence to Blandville, to Wickliffe and from Wickliffe back to Paducah. The entire project will involve an expenditure of about $4,000,000.

LOUISVILLE, KY.—It is expected that the large addition to the

plant of the Kentucky Electric Company, of Louisville, Ky., will be completed about Dec. 1.

LOUISVILLE, KY.—W. O. Head, Mayor, has announced a plan for making use of the water power developed at the falls of the Ohio, opposite the city. If the plan is feasible, it is stated that Eastern capitalists have expressed a willingness to provide the necessary funds. Mayor Head believes that the power can be utilized, although engineers who have studied the question are doubtful as to this.

LAFAYETTE, LA.—The City Council is reported to have provided for an issue of $60,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant, water-works and other improvements.

NEW ORLEANS, LA.—Owing to the increase in rates for electricity for lamps and motors by the Consumers' Electric Company and the New Orleans Railway, Light & Power Company, Fuerst & Kramer, Ltd., have announced that they will install a power plant to operate their works.

CORINA, MAINE.—The local electric-light plant was destroyed by fire on Sept. 20. At present the town is without electrical service.

VAN BUREN, MAINE.—The Van Buren Light & Power Company has applied to the State Highway Commissioner for authority to carry its transmission line on the new international bridge between Van Buren, Maine, and St. Leonards, N. B. The request involves the authority for the use of the bridge and the right to transmit electricity out of the State.

WATERVILLE, MAINE.—The Central Maine Power Company has purchased a controlling interest in the Waterville & Fairfield Railway & Light Company and the Waterville & Oakland Street Railway Company. Through this deal the company secures entire control of the water in the Belgrade chain of lakes.

BOSTON, MASS.—The directors of the Boston Elevated Railway Company have called a special meeting of the stockholders to authorize an issue of bonds not to exceed $5,000,000 to provide funds for construction and equipment, for floating debt, purchase or real estate, etc.

CHICOPEE, MASS.—The Electric Light Commissioners have approved the report of C. W. Whiting, of Boston, Mass., consulting engineer, recommending improvements to the municipal electric-light plant involving an expenditure of $90,000. The report did not include equipment for the street-lighting system and the commissioners have recommended an extra $6,000 for that purpose.

HOLDEN, MASS.—At an election held recently the proposition to build an electric distributing plant, the cost not to exceed $10,000, was carried. The Selectmen have engaged William D. Thompson, of Worcester, Mass., as consulting engineer in connection with the installation of an electric-lighting system in Holden.

WOBURN, MASS.—Work has begun on the proposed addition to the Bay State Street Railway Company's power station in East Woburn. The building will be 37 ft. x 67 ft. The equipment will include a 400-hp boiler and a 1200-hp engine. The five boilers in use will be rebuilt. The total cost of the improvement is estimated at $130,000. Andrew Moffatt, of Lowell, Mass., has charge of the work.

WORCESTER, MASS.—The County Commissioners have made arrangements with the Worcester Electric Light Company to supply electricity for lamps and motors at the courthouse.

ALLEGAN, MICH.—The property of the Allegan Light & Power Company has been taken over by W. A. Foote, president, and J. B. Foote, general superintendent of the Commonwealth Power Company, of Jackson, Mich. It is understood that the new owners will make improvements to the plant and service.

ALPENA, MICH.—The property of the Alpena Mutual Benefit Telephone Company is reported to have been purchased by M. T. Streeter, of Lansing, Mich., representing the Onaway Telephone Company. It is understood that Alpena will be the center of an independent system in this part of the State and a new plant with metallic circuits will be erected here.

BATTLE CREEK, MICH.—A site has been purchased on West Jackson Street by C. W. Post, on which, it is stated, he will erect a newspaper publishing office, power plant and other buildings.

KALAMAZOO, MICH.—The Commonwealth Power Company is reported to be contemplating the erection of a steel tower transmission line between Kalamazoo and Otsego.

LANSING, MICH.—Plans have been approved by the State Railroad Commission for an exensive water-power system contemplated by the Consolidated Power & Light Company, of Detroit, Mich., which includes the construction of five dams to supply power for a high-tension electric transmission system. Bonds to the amount of $500,000 have been authorized by the commission. The company proposes to operate in Clare, Midland, Ionia, Belding, St. Johns, Alma, St. Louis and Saginaw. J. L. Hudson is president of the company, and C. L. Abbott vice-president and manager.

PENTWATER, MICH.—The new transmission line of the Stearns Lighting & Power Company to Pentwater and Hart is nearly completed. A 1000 hp turbo-generator is being installed in the local power house, which will increase the generating capacity of the plant by 50 per cent.

FARMINGTON, MINN.—It is reported that a company has been organized to establish an electric-light plant in Farmington, to cost approximately $5,000. C. S. Lewis is secretary of the company.

GILBERT, MINN.—We are informed that plans are being considered for the construction of a hydroelectric plant to supply electricity in Gilbert, Aurora and Gilbert, but as yet no preliminaries have been arranged.

LINDSTROM, MINN.—It is reported that the Minneapolis General Electric Company is contemplating extending its system to Lindstrom and Center City.

MORRIS, MINN.—The City Council is considering the installation of cluster-lamps, at a cost of about $3,000.

WINONA, MINN.—Howard Morris, of Milwaukee, Wis., receiver for the Winona Railway & Light Company, has appointed R. M. Howard, of Clinton, manager of the Winona plant.

LAUREL, MISS.—The Gulf States Investment Company, which owns the local electric-light and power plant, is contemplating the construction of a street-railway system, for which application for a franchise will soon be made to the City Council. P. H. Saunders, of Laurel, vice-president of the company, is interested in a project to build an interurban railway from Laurel to Hattiesburg.

SPRINGFIELD, MO.—Plans are being prepared by the Ozark Bell Telephone Company for the erection of a long-distance copper circuit telephone line from Springfield, Mo., to Memphis, Tenn., to cost approximately $100,000. The new line, which will be independent of all other lines, will be strung on the Western Union Telegraph poles along the "Frisco."

OAKLAND, NEB.—Negotiations are under way between A. T. Martin, of Denver, Col., and local business men with a view of installing an electric-light plant in Oakland.

COBRE, NEV.—The Western Asset Company is planning to build a hydroelectric plant on the Little Salmon River to supply electricity to operate its mines near Valley Pass. An electric smelting plant is to be erected at Contact.

MORRISTOWN, N. J.—Extensive improvements are contemplated by the Morris & Somerset Electric Company to its system, including the erection of an addition to its power house on Whipple Street to provide space for the installation of additional machinery, contracts for which have already been placed. The company has purchased a 350-hp Babcock & Wilcox boiler, one 750-kw, 2300-volt, steam turbo-generator set and a 25-kw generator from the Allis-Chalmers Company, of Milwaukee, Wis.; surface condenser and pumps from the C. H. Wheeler Mfg. Company, of Philadelphia, Pa.; a marble switchboard and transformers from the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa. The company is extending its transmission line to Florham Park for the purpose of supplying electrical service in that place. Street lighting equipment for Florham Park has already been purchased.

PRINCETON, N. J.—The contract for building a conduit system and piping in power house in connection with the construction of the graduate school at Princeton University has been awarded to John L. Reid, of Newark, N. J., for $28,987.

TRENTON, N. J.—The Trenton Street Railway Company has issued $300,000 in bonds, the proceeds to be used for improvements and betterments to its property.

WEST ORANGE, N. J.—The Town Council has authorized a renewal of the contract for street lighting with the Public Service Electric Company for a period of five years. Under the terms of the new contract the company is to supply arc lamps at $80 each per year, which is a reduction of $5 per year from the price paid under the present contract.

BROOKLYN, N. Y.—Sealed bids will be received by C. B. J. Snyder, superintendent school buildings, Department of Education, Park Avenue and Fifty-ninth Street, borough of Manhattan, New York, N. Y., until Oct. 2 for installing electric equipment in additions to and alterations in Boys' High School, on Marcy Avenue, between Madison and Putnam Streets, Brooklyn, N. Y. Blank forms, plans and specifications may be obtained at the above office and also at the branch office, 131 Livingston Street, Brooklyn, N. Y.

GENESEO, N. Y.—The Board of Trustees has granted the Geneseo Gas & Electric Company a new franchise for a period of twenty-five years to supply gas and electricity for lamps, heat and motors. The franchise also provides for a twenty-four-hour service.

HARTWICK, N. Y.—Preparations are being made by the Electric Power & Heating Company for the installation of a street-lighting system in Hartwick.

NEW YORK, N. Y.—Sealed bids will be received by the Board of Health, Department of Health, Fifty-fifth Street, New York, N. Y., until Oct. 3, for furnishing and installing electric and gas fixtures, temporary supply feeders, etc., together with all necessary alterations and other work incidental thereto, for two concrete pavilions on the grounds of Riverside Hospital, at North Brother Island, borough of the Bronx. Blank forms and plans for the above work and further information may be btained at the office of the chief clerk of the Department of Health. Ernst J. Lederle, Ph.D., is president of Board of Health.

SILVER SPRINGS, N. Y.—The General Electric Company has been awarded the contract for furnishing electrical equipment for the proposed municipal electric-light plant, including generator, exciter, switchboard, etc., and wiring streets.

BRYSON, N. C.—It is reported that the Council has engaged C. G. Logan, of Waynesville, N. C., electrical engineer, to take charge of the installation of the proposed municipal electric-light plant, machinery for

which has already been purchased. The work will include construction of dam and brick substation, 14 ft. x 20 ft. The cost of dam is estimated at about $9,000.

ORIENTAL, N. C.—The question of calling an election to submit the proposition to issue bonds for the installation of an electric-light plant to a vote is under consideration.

RALEIGH, N. C.—The business men have submitted a proposition to the Board of Aldermen offering to pay for the installation of cluster lamps on Martin and Fayette Streets, providing the city would furnish electricity to maintain them.

RUTHERFORD, N. C.—The Town Council has awarded the contract for equipment for the proposed municipal electric-light plant to the Carolina Electrical Company, of Raleigh, N. C.

BOWLING GREEN, OHIO.—The receivers of the Lake Erie, Bowling Green & Napoleon Railway Company, which operates an electric railway extending from Tontogany to Woodville and an electric plant and hot-water heating system in Bowling Green, have secured from Federal Judge Killits authority to commence work on improvements to the system, involving an expenditure of $50,000. It is proposed to rebuild and enlarge the local plant. The work will be done under the supervision of C. B. Rogers, manager.

BRADFORD, OHIO.—The Town Council has granted C. C. Smith a franchise to construct and operate an electric-light plant in Bradford.

CANFIELD, OHIO.—Application has been made to the Council by Jarvis Smith for a franchise to install and operate a natural gas and electric-light plant in Canfield.

CINCINNATI, OHIO—The power plant, car barns and rolling stock of the Cincinnati & Eastern Interurban Company were completely destroyed by fire on Sept. 22, causing a loss of about $125,000.

CINCINNATI, OHIO.—The Cincinnati, Georgetown & Portsmouth Railroad Company and the Ohio River & Columbus Railroad Company have been consolidated. The deal is said to have involved about $3,000,000. It is understood that the Ohio River & Columbus Railroad will be equipped for electrical operation. Robert Hackney has been elected president and treasurer and E. E. Garbreath vice-president and general manager.

CLEVELAND, OHIO.—The City Council has voted to submit the proposition to issue $2,000,000 in bonds, the proceeds to be used for the erection of a municipal electric light plant, at the election to be held in November.

COLUMBUS, OHIO.—Proposals will be received by the Director of Public Safety, City Hall Building, Columbus, Ohio, until Oct. 6 for furnishing lead-covered underground cable for the sub-department of fire of the Department of Public Safety as follows: For 3116 ft., twenty-pair lead-covered underground cable; 3225 ft. fifteen-pair lead-covered underground cable; 1739 ft., ten-pair lead-covered underground cable; 856 ft., five-pair lead-covered underground cable. E. L. McCune is director of public safety.

CUYAHOGA FALLS, OHIO.—The Village Council has passed an ordinance granting the Falls Rivet & Machine Company a franchise to erect and operate a power, lighting and heating system, provided the plant is built within six years.

DELAWARE, OHIO.—The Delaware Electric Light, Heat & Power Company has submitted a proposition to the City Council offering to sell its plant to the city for $137,500.

LOVELAND, OHIO.—The Loveland Citizens' Electric Company has filed amendments to its charter, changing its name to the Loveland Electric, Ice & Water Company.

TOLEDO, OHIO.—The Toledo, Ann Arbor & Jackson Railroad Company, recently organized, it is reported, is contemplating taking over the property of the old Toledo, Ann Arbor & Jackson electric railway, which was organized in 1905, and built an electric railway, 20 miles in length, the next year and then ceased operations. The new company will be capitalized at $500,000, of which the proceeds of $300,000 will be used in purchasing the assets and property of the old railway and the remainder for further construction.

COLLINSVILLE, OKLA.—The contract for construction of the proposed municipal electric-light plant has been awarded to C. A. Reece, of Collinsville. Bonds to the amount of $45,000 were recently voted to provide funds to install the plant.

ALSEA, ORE.—The Forest Service is planning to erect a telephone system between Alsea and Florence, a distance of 15 miles.

BAY CITY, ORE.—The new plant of the Tillamook Public Service Company was recently put in operation. The company has been awarded a contract for lighting the streets of the city. The contract calls for twenty-five arc lamps. The plant has sufficient output to supply 1400 lamps. J. H. West is superintendent.

BURNS, ORE.—James D. Fellows, who was recently granted a franchise to operate an electric-light system in Burns, has purchased a power site and is planning to build a plant on Emigrant Creek, and the local electric-light plant owned by Horton Brothers has also been taken over. It is expected to have the new power plant in operation early next spring. Arrangements are being made to supply electricity for lamps from the present system by the middle of next month. It is proposed to secure power from the flour mill. J. E. Wheeler is associated with Mr. Fellows in the enterprise. The proposed plant will develop about 400-hp and a twenty-four hour service will be established.

EUGENE, ORE.—The Oregon Electric Railway Company has been granted a franchise to construct and operate a loop line in Eugene. C. R. Gray is president of the company.

EUGENE, ORE.—The Portland, Eugene & Eastern Railway Company has awarded the contract for road construction on its proposed railway from Eugene to Corvallis to William Case. Work on equipping the Alsea branch for electrical operation will begin in October. A. Welch is manager.

HERMISTON, ORE.—The Hermiston Telephone & Electric Company, recently organized, is planning to install a system throughout this district, with central station at Hermiston.

HOOD RIVER, ORE.—The Pacific Power & Light Company has closed its electric plant in Hood River. Electricity for this district is supplied from the White River power plant over the new transmission line, via The Dalles.

LEBANON, ORE.—Plans are being prepared by the Lebanon Lumber Company for the construction of an electric power plant to supply electricity for lamps and motors for its mill.

MARSHFIELD, ORE.—The Smith-Powers Logging Company is reported to be contemplating the installation of a central electric power plant to operate a lumber mill.

McMINNVILLE, ORE.—Plans are being considered for the installation of an ornamental street-lighting system in the business district. It is proposed to install ornamental lamp standards, each carrying three lamps and to place the wires underground.

PORTLAND, ORE.—The City Council has granted a revocable franchise for a period of two years to the Mount Hood Railway & Power Company for the extension of its electric railway to Montavilla, connecting with the lines of the Portland Railway, Light & Power Company.

SPRINGFIELD, ORE.—The Oregon Power Company has submitted a proposition to the City Council and the Commercial Club offering to install an ornamental street-lighting system in Springfield. The company agrees to install the system and divide the cost into equal monthly payments on a five-year contract. At the expiration of the contract the system will become the property of the city.

PANAMA.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until Nov. 20 for furnishing electric towing locomotives for the canal locks. Blanks and general information relating to this circular (No. 650) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

GLENDON (R. F. D.), EASTON, PA.—The Glendon Power Company has applied to the Town Council for a franchise to erect electric transmission lines through the town.

MAHANOY CITY, PA.—Negotiations have been closed whereby the property of the Schuylkill Gas & Electric Company, of Mahanoy City, has been taken over by the Harwood Electric Company, of Hazleton, Pa. Electricity for operating the local system will be supplied from Harwood and the plant in Mahanoy will be used as a substation.

MOUNTVILLE, PA.—The Borough Council has adopted an ordinance providing for the installation of a street-lighting system. It is proposed to install ninety incandescent lamps of 40 cp.

WILKES-BARRE, PA.—The Wilkes-Barre Light Company, recently organized, has been granted a seventy-five-year franchise to operate in Wilkes-Barre. John J. Cumming and Joseph Dunfee, of Syracuse, N. Y., are interested in the company.

MANILA, P. I.—Sealed proposals will be received at office of Major C. H. McKinstry, officer in charge of defensive works, Headquarters Philippines Division, Manila, P. I., until Dec. 4, 1911, for furnishing engines, generators, synchronous converters, and potential transformers. Further information can be obtained on application to the above office or to Chief of Engineers, United States Army, Washington, D. C.

UNION, S. C.—Extensive improvements have been made to the municipal electric-light plant and water-works system. The interior of the plant has been remodeled and all steam and electric lines placed in ducts under the concrete floor. New equipment has been installed, including a 75-kw, three-phase, 60-cycle, "Hawthorn" generator, direct connected to a 135-hp Harrisburg engine, with necessary switchboards. R. A. Easterling is superintendent.

ADAMS, TENN.—Plans are being considered for the construction of an electric-light plant in Adams. A stock company has been organized to operate the system. A site has been purchased on which the proposed plant will be erected. H. W. Tyson, of Glenraven; D. F. White and J. D. Stoltz, of Adams, are interested in the project.

CHATTANOOGA, TENN.—The Merchants' Association has submitted a proposition to the Board of City Commissioners for the establishment of an ornamental lighting system. The association agrees to erect and maintain the lamp standards and wiring, provided the city will furnish electricity for same.

MEMPHIS, TENN.—The Commissioner of Public Utilities, Grounds and Buildings has authorized the Merchants' Power Company to erect sixty-two additional arc lamps on Main Street from Railroad Avenue to Concord Avenue.

MEMPHIS, TENN.—Application has been made for a charter for the West Tennessee Traction Company by A. G. Riley, Alfred Sohm, W. W. Swift and C. L. Winchester. The company will be capitalized at $100,000 and proposes to build an electric railway from Memphis to Jackson, thence to Nashville.

SHAWANEE, TENN.—It is reported that plans are under way for the construction of a dam on Powell's River, at Massengilford, 2 miles south of Shawanee. Electricity generated at the plant will be transmitted to Middleboro and Jelico, and will also supply power to operate an electric railway to the pinnacle at Cumberland Gap and on to the Lincoln Memorial University and thence to Shawanee.

CAMERON, TEX.—The City Council has granted the Hamilton Brothers Construction Company a fifty-year franchise to install and operate new water-works and lighting systems in Cameron.

COMMERCE, TEX.—The capital stock of the Commerce Ice & Power Company has been increased from $35,000 to $50,000.

DEL RIO, TEX.—D. B. Chapin and associates, who are preparing to erect a large dam across Devil's River to obtain a water supply for irrigating about 150,000 acres of land and to operate a hydroelectric plant, have completed surveys for the proposed work. The dam will be about 185 ft. high.

DENTON, TEX.—The Denton Traction Company has applied for an amendment to its charter permitting it to supply electricity for lamps now instead of waiting five years longer, as authorized under the original charter. The company offers to supply electricity at 12½ cents per kw-hour against 15 cents per kw-hour charged by the municipal electric plant. In consideration for the amendment it is said that the company will supply energy for street lamps for five years free of charge.

DERMOTT, TEX.—The Dermott Townsite Company, it is said, is planning to install a lighting system. Frank M. White is general agent.

FORT WORTH, TEX.—The Stone & Webster Engineering Corporation, of Boston, Mass., has awarded the contract for grading its interurban electric railway between Fort Worth and Waxahachie, a distance of about 35 miles, to Denison & Ramsay, of Lubbock, Tex. The contract for grading the proposed electric interurban railway between Fort Worth and Cleburne, 29 miles in length, has been awarded by the Stone & Webster Engineering Corporation to the Texas Building Company, of Fort Worth.

FOWLERTON, TEX.—The Fowler Brothers Land Company is reported to be contemplating the installation of an electric-light, ice and cold-storage plant, to cost approximately $40,000. B. D. Hatcher is manager of farm sales department. Fowlerton has not a post office.

BRIGHAM CITY, UTAH.—At an election held recently in the newly incorporated town of Honeyville the proposition to issue bonds to the amount of $12,000 for the installation of an electric-light plant and water-works system was carried. The cost of the electric-light plant is estimated at $5,000, and the water-works system at $7,000.

MONROE, UTAH.—The Town Council has authorized a special election to be held Oct. 12 to submit the proposition to issue $10,000 in bonds, the proceeds to be used to purchase the local electric-light plant, to be owned and operated by the municipality.

PROVO, UTAH.—The Knight Power Company is contemplating further extensions to its system in this State. The company is planning to erect another plant early next year to be located about 8 miles from the present plant on Snake Creek, near Heber.

SALT LAKE CITY, UTAH.—An isolated electric generating plant will be installed in the Daniels Theater building, now being remodeled.

SALT LAKE CITY, UTAH.—Plans are being considered for the construction of an electric railway from Salt Lake City to Provo and Payson, for which preliminary surveys will be made. George M. Cannon, of the Real Estate Association, is interested in the project.

DANVILLE, VT.—Investigations are being made by the St. Johnsbury Electric Company, of St. Johnsbury, in Danville with a view of extending its system to that village. The plan contemplates lighting the streets as well as the residences.

ST. JOHNSBURY, VT.—Work has begun on the erection of a new generating plant for the St. Johnsbury Electric Company on the Carrick property. The H. P. Cummings Construction Company, of Ware, Mass., has the contract. The power house will be 120 ft. by 30 ft.

RICHMOND, VA.—Application has been made to the City Council by the Richmond & Henrico Railway Company for a franchise to supply electricity for lamps and motors along the streets over which its railway operates. The company, it is said, is planning to extend its railway in sections of the city not now served by street railways. The power house of the company is located at the foot of Nicholson Street, which it proposes to enlarge if granted a franchise to supply electrical energy for commercial and domestic purposes.

ATTALIA, WASH.—Negotiations have been closed between the Pacific Power & Light Company and the Attalia Land Company whereby a substation will be erected in Attalia, work on which will begin at once.

BLAINE, WASH.—Property has been acquired at the international boundary by G. H. Wescott as a site for the proposed electric power plant of the British Columbia Electric Railway, which proposes to supply electricity in Blaine. Electrical service is now supplied by a municipal plant.

CHEHALIS, WASH.—The Chehalis & Cowlitz Railroad Company, it is said, will equip its system through Chehalis for electrical operation.

ELLENSBURG, WASH.—We are informed that improvements are contemplated to the municipal electric-light plant, involving an expenditure of about $30,000. G. M. Miller, of Ellensburg, Wash., is engineer in charge.

KLICKITAT, WASH.—The Pacific Power & Light Company is erecting a 66,000-volt transmission line, for emergency purposes, from its power plant on the Little Klickitat River to The Dalles, Ore. A distributing system will later be built in the Horseshoe Bend district, near Klickitat.

LYLE, WASH.—The Puget Sound Bridge & Dredging Company, of Seattle, Wash., is reported to have secured the contract for construction of a dam on the Klickitat River, near Lyle, for the Northwestern Electric Company, of Portland, Ore., in connection with its proposed hydroelectric power plant.

MORTON, WASH.—The Town Council has granted a franchise to A. W. Van Arsdale to install an electric light and water system in Morton.

SEATTLE, WASH.—Plans are being considered by the Seattle, Renton & Southern Railway Company for the erection of a substation on Rainier Avenue.

TACOMA, WASH.—The Federal Court has ordered the foreclosure and sale of the property of the Home Telephone Company of Tacoma to satisfy a judgment of $1,637,000 and interest on the company's bonds due for two years past. The city of Tacoma, it is said, may purchase the property.

WATERVILLE, WASH.—The Wenatchee Gas & Electric Company is reported to have acquired the Waterville electric power plant on the Entait River. It is understood that improvements will be made in the service.

BENWOOD, W. VA.—The Ohio Valley Electric Company has applied to the County Commissioners for a franchise to erect transmission lines over the county roads from Benwood to Moundsville and into Sherrard and Mozart districts.

ENDEAVOR, WIS.—A stock company is being organized in Endeavor to develop a water power to operate an electric light and power plant. The company will be known as the Endeavor Light & Power Company and will be capitalized at $10,000. A transmission line, 10 miles in length, will be erected. For further information address W. H. Burwell, of Endeavor, Wis.

VICTORIA, B. C., CAN.—The Special Council committee has awarded the contract for the installation of cluster lamps on Fort Street to Hutchinson Brothers, at $5,827.

MIMICO, ONT., CAN.—The ratepayers have voted in favor of the by-law providing for the installation of a local electric distributing plant in Mimico. Energy for operating the system will be supplied by the Hydroelectric Power Commission.

OTTAWA, ONT., CAN.—The Canadian Bell Telephone Company has announced that it will increase its capital stock from $12,500,000 to $15,000,000.

SARNIA, ONT., CAN.—Contracts have been awarded by the Sarnia Gas & Electric Company for equipment for its power plant as follows: To the Goldie McCulloch Company, of Galt, Ont., Can., for boilers receivers, piping, a condenser and a mixed-pressure turbo-generator; three-phase, 60-cycle generators to Kilmer, Pullen & Burnham, of the Swedish General Electric Company; to the Canadian Westinghouse Company for three exciter sets; for switchboard to the Canadian General Electric Company; the Deane Steam Pump Company, of Holyoke, Mass., for pumps and water weigher to Henry Worthington, of New York, N. Y.

STEELTON, ONT., CAN.—Tenders will be received by James Robinson, town clerk, until Oct. 3 for installation of an electric-lighting system as follows: Contract B—Erection of brick substation and house tower. Contract K—Furnishing and erecting complete electrical equipment for lighting system, including substation equipment. Contract M—For fire alarm equipment. Plans and specifications may be seen at the office of the town clerk, Steelton, and at the office of Chipman & Powers, engineers, 204 Mail Building, Toronto, Ont., Can.

MONTREAL, QUE., CAN.—The Shawinigan Water & Power Company has decided to issue $1,000,000 in additional capital stock, to be offered to the shareholders at $108 on the basis of one new share for each nine shares now held. Part of the proceeds will be used to cover a portion of the cost of the new power development which has been in course of construction during the past year and a half. This development will double the output of the electrical plant and furnish the power necessary to carry out the contract recently made with the Montreal Light, Heat & Power Company. The company expects to place its new plant in operation by Oct. 1.

OAXACA, MEX.—Maurice Clark, operating mining property in the Chivo Mountain district, is reported to be at the head of a project to supply that mining district with electricity for lamps and motors.

New Industrial Companies.

THE CANTON ELECTRIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $3,000,000 to develop and manufacture a number of electrical inventions. The officers of the

company are: Allen A. Canton, president; Philip Nemoff, vice-president; I. E. A. Konigsberg, secretary and treasurer; the directors are Dr. J. H. Bair and General J. L. Weaver.

THE DRIEST-HOERBER COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $25,000 for the purpose of manufacturing surgical, chemical, electrical and scientific instruments. The incorporators are C. Dreist, C. Hoerber, of New York, N. Y., and L. M. Day, of Atlantic City, N. J.

THE EASTERN NOVELTY & LIGHTING COMPANY, of Westfield, Mass., has been granted a charter with a capital stock of $50,000 to manufacture novelties in lighting apparatus. J. C. Thompson is president and G. H. Sharp, of Westfield, Mass., treasurer.

THE ELECTRIC RAILWAY MAINTENANCE ASSOCIATION, of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general consulting and electrical engineering business. The incorporators are: Albert B. Herrick, 230 West Twenty-second Street, New York, N. Y.; Clarence G. Boyden, 940 Fox Street, the Bronx, New York, N. Y., and John K. Mann, 2584 Bedford Avenue, Brooklyn, N. Y.

THE ELECTRIC TRUCK COMPANY, of Kansas City, Mo., has filed articles of incorporation with a capital stock of $2,000. The incorporators are John M. Egan, Louis H. Egan and J. A. Harder.

THE FLORENCE ELECTRIC TRAY COMPANY, of Chicago, Ill., has been incorporated by Florence L. Crombic, William H. Benes and Elnar C. Howard. The company is capitalized at $75,000 and proposes to manufacture and deal in electrical and other specialties.

THE HIMES-COX STUDIOS, of New York, N. Y., has filed articles of incorporation with a capital stock of $60,000 to manufacture and deal in lighting fixtures, globes, bronzes, etc. The incorporators are F. Himes-Cox, G. O. Howe and S. S. Newton, of New York, N. Y.

THE GEORGE A. JACKSON COMPANY, of Boston, Mass., has been incorporated with a capital stock of $25,000 to deal in electrical supplies and machinery. E. I. Jackson is president, and G. A. Jackson, of Newton, treasurer.

THE JONES MARTIN COMPANY, of New York, N. Y., has been incorporated by D. Carroll Jones, 611 West 111th Street, New York, N. Y.; Miles I. A. Martin and Charles C. Kiefer, both of 160 Broad Street, Newark, N. J. The company is capitalized at $25,000 and proposes to manufacture and deal in scientific and electrical instruments, etc.

THE KROTZER COMPANY, of Buffalo, N. Y., has been granted a charter with a capital stock of $10,000 to manufacture machinery, motors, engines, etc. The incorporators are: Louis E. French, I. G. Holendar and Christopher M. Baldy, all of Buffalo, N. Y.

THE LAMAR ENGINEERING COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $12,000 by George M. Sachs, Siegfried M. Sachs and S. E. Schuchart, all of New York, N. Y.

THE MAXANT ENGINEERING & MANUFACTURING COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $100,000 to do a general mechanical, electrical engineering and manufacturing business. The incorporators are: Basil Maxant, Frank Maxant and William D. Johnson.

THE MIDLAND ELECTRIC HEATING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to do a general electrical manufacturing business. The incorporators are: Kichard W. Thornton, Julius Goldszier and Henry Hiestand.

THE MULTIPLE STORAGE BATTERY COMPANY, of New York, N. Y., has been incorporated by R. K. McGonigal, C. W. Schadler and J. Cornillios, all of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical apparatus.

THE NEW ENGINEERING & CONSTRUCTION COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: G. C. Stiegler, G. W. Dillman and B. M. Grawl, of Wilmington, Del.

THE NEW STATE CONSTRUCTION COMPANY, of Prescott, Ariz., has been incorporated with a capital stock of $100,000 to engage in electrical construction work and to deal in electrical supplies. The officers are W. B. Shelvley, president; W. H. Tharp, vice-president, and V. H. Melick, secretary and treasurer.

THE ORNAMENTAL LIGHTING POLE COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of manufacturing lighting poles, supplies, etc. The incorporators are: Harvey S. Tonks, 17 Battery Place; Ernest Ziegler, 135 Broadway, both of New York, N. Y., and William J. Nunes, 82 Clark Street, Jersey City, N. J.

THE PEARSON ENGINEERING COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 to manufacture engines, pumps, etc. F. W. Hayden is president and W. E. Pearson, of Boston, Mass., treasurer.

THE PENNSYLVANIA ELECTRICAL CONSTRUCTION COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $50,000 by Thompson H. Lukens and Bruyn Snyder, of Philadelphia, Pa., and Edwin R. Cochran, Jr., of Wilmington, Del.

THE RANSOME ENGINEERING COMPANY, of New York, N. Y., has been incorporated by Ernest J. Ransome, 910 Madison Avenue, Plainfield, N. J.; A. Wilfred Ransome, 923 Woodland Avenue, Plainfield, N. J., and J. Walter Neville, 859 Sixty-first Street, Brooklyn, N. Y. The company is capitalized at $50,000 and proposes to do a general contracting business.

THE REFLEX INSPECTION LIGHT COMPANY, of Mount Vernon, N. Y., has been incorporated with a capital stock of $25,000 by Gustav Musskern, August Benkert, 43 Stevens Avenue, and William H. Pease, 119 Washington Street, all of Mount Vernon, N. Y. The company proposes to manufacture and deal in inspection lamps, etc.

THE SMITH GASOLINE MOTOR COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $350,000 for the purpose of manufacturing and dealing in motors, engines, automobiles, etc. The incorporators are: W. H. White, Jr.; D. M. Baldwin and W. H. Bardy, all of New York, N. Y.

THE H. F. SMITH'S ELECTRIC LOCK STRIKE COMPANY, of Richmond, Va., has been incorporated with a capital stock of $50,000. The officers are H. F. Smith, president; George J. Hooper, vice-president, and J. S. Hopkins, secretary and treasurer. The company proposes to manufacture and sell Smith's electric lock strike.

THE SUPERVISING ENGINEERING COMPANY, of Portland, Maine, has been incorporated with a capital stock of $50,000 to do a general engineering business. H. Knowlton is president of the company and W. J. Knowlton, treasurer, both of Portland, Maine.

THE TELEGRAPHONE SALES COMPANY, of Providence, R. I., has been incorporated by Ralph V. Hadley, of Providence, R. I.; Benjamin F. Lindemuth, of Bristol, R. I., and Col. Frank T. Easton, of Providence, R. I. The company is capitalized at $1,000,000 and proposes to manufacture and deal in telegraphonic and telephonic instruments, phonographs, graphophones and all kinds of electrical instruments; also acquiring patent rights and similar privileges for any invention and selling patents, etc.

New Incorporations.

MARTINEZ, CAL.—The Mt. Diable Telephone Company has been incorporated with a capital stock of $5,000. The officers are: H. C. Wetmore, president; Charles Gordon, secretary, and Percy Douglas, treasurer.

ATLANTA, GA.—The Etowah Valley Railway Company has been granted a charter with a capital stock of $50,000 for the purpose of building a railway from Ball Ground in Cherokee County extending along the Etowah River to the Tennessee line in Towns County. The incorporators are: G. R. Glenn, H. D. Curley, John H. Moore and others. The headquarters of the company will be located in Atlanta.

CHRISTOPHER, ILL.—The Christopher Electric Company has filed articles of incorporation with a capital stock of $20,000. The incorporators are Thomas Horn, Albert E. Pike, H. M. Rea and T. D. Parkhill.

OTTAWA, ILL.—The La Salle Electric Railroad Company has filed application for a charter to build an electric railway from Ottawa to Mendota, a distance of 26 miles. Work on construction of the proposed railway will begin this fall. The officers are G. H. Dodge, president; Boyd Weaver, secretary; O. D. Weaver, Jr., treasurer, and Fred S. Abraham, chief counsel, all of Chicago, Ill.

CONNERSVILLE, IND.—The Hydro-Electric Light & Power Company has been incorporated with a capital stock of $10,000 by J. M. Sade, Lewis R. Johnson and E. D. Johnson.

RICHMOND, IND.—The Richmond & Eastern Traction Company has been granted a charter with a capital stock of $50,000. The directors are: S. E. Jones, W. H. Quigg, C. Jordan and A. G. Bartel.

PORTLAND, MAINE.—The Santiago Light, Heat & Power Company has filed articles of incorporation with a capital stock of $250,000 for the purpose of doing a general lighting, heating and power business. The officers are W. W. Copeland, of Whitman, Mass., president, and G. C. Colt, of Winchester, Mass., treasurer.

HENDERSONVILLE, N. C.—The Hendersonville Traction Company has filed articles of incorporation with a capital stock of $100,000 to construct and operate an electric railway and light and power plant. The incorporators are: N. C. Statton, D. S. Pace and others.

Personal.

MR. HARRY F. WALKER, formerly of Jacksonville, Ill., has been appointed manager of the properties of the Illinois Telephone Company at White Hall, Ill.

MR. J. N. PREWITT, chief electrician of the Trinity & Brazos Valley Railway Company, has tendered his resignation, effective Oct. 1. Mr. Prewitt's successor has not yet been named.

PROF. JOHN PRICE JACKSON, dean of the School of Engineering of Pennsylvania State College, was elected at the recent meeting of the Pennsylvania Electrical Association the first honorary member of that body.

PROF. W. S. GORTON, of Johns Hopkins University, will take up in electrical engineering department of the Massachusetts Institute of Technology the work of Prof. H. W. Smith during the absence abroad of the latter.

MR. R. M. HOWARD has been appointed manager of the Winona Railway & Light Company. Mr. Howard has been connected with the Green Bay Gaslight & Street Railway Company and has had twenty years' experience in electrical work.

MR. HUGH L. COOPER, of New York, vice-president of the Mississippi River Power Company, which is building the dam across the Mississippi at Keokuk, will speak Oct. 19 before the St. Louis League of Electrical Interests on "Engineering Features of the Keokuk Water Power Company."

MR. WILLIAM S. TAUSSIG, formerly connected with the Chicago office of the General Electric Company and now assistant to the president of the General Electric Company of Texas, with headquarters at Dallas, was a visitor in Chicago last week and attended the meeting of the Electric Club, of which he was formerly secretary.

PROF. HAROLD B SMITH, who has been in charge of the electrical engineering department at the Worcester Polytechnic Institute, is leaving for a two years' absence. Prof. J. O. Phelon will be in charge as acting director, and Mr. R. L. Witham, of the class of 1908, will be at the head of the work in electrical design.

PROF. CLARENCE A. PIERCE, of Cornell, succeeds Prof. George R. Oishausen at Worcester Polytechnic Institute in the work of theoretical electrical engineering. Mr. M. F. Clement succeeds Mr. R. H. Taber as graduate assistant in the electrical engineering departmnt. Mr. Taber is now with the Westinghouse company in Pittsburgh.

MR. JENS BACHE-WIIG, engineer of the Westinghouse Electric & Manufacturing Company in charge of alternating-current generator and rotary converter design, has been appointed by the Norwegian government professor in electrical engineering at the Norwegian Technical University in Trondhjem, Norway, to take effect Jan. 1, 1912.

MR. GEORGE B. COLEMAN, special power engineer of the Rockford (Ill.) Electric Company, will give an illustrated lecture in that city to manufacturers and business men and the general public the latter part of October, on "The Electric Motor in the World's Work." This will be illustrated by three dozen pictures of motor drives in Rockford, together with views from plants all over the United States.

DR. A. E. KENNELLY, who attended as an A. I. E. E. delegate the meetings in Turin of the International Electrotechnical Commission and the International Electrical Congress, in which latter he served as president of one of the eight sections, sailed for home on Sept. 22. After the adjournment of the congress, Dr. Kennelly served on a jury at Liège, Belgium, which made an award of $2000 for the best triennial thesis offered by a student of the Montefiore Technical Institute.

MR. A. N. RICHARDSON, who is general superintendent of the Kansas City Electric Light Company, was for a number of years located at Ann Arbor, Mich., with the Washtenaw Light & Power Company, later the Washtenaw division of the Eastern Michigan Edison Company, coming to Kansas City in November, 1910. The former general manager of the Kansas City company, Mr. R. E. Richardson, has been succeeded there by Mr. Louis M. Egan, the son of Mr. John M. Egan, president of the company. Mr. R. E. Richardson is now general manager of the Commonwealth Power Company, with offices at Jackson, Mich.

MR. EDWIN R. WEEKS was appointed an official delegate to represent the American Institute of Electrical Engineers at the National Conservation Convention meeting at Kansas City, Mo., Sept. 25 to 27. Mr. Weeks, who is now a consulting engineer of Kansas City, is a member of the Institute and was an early vice-president, and in 1889-90 president of the National Electric Light Association. To him also belongs the honor of having designed the association's badge. In the recollection of older central-station men the Kansas City convention of the body during Mr. Week's presidency still lingers, marked by the largest attendance and most notable program of all the meetings held up to that time.

MR. P. T. GLIDDEN, who was elected general manager of the Louisvile Lighting Company, of Louisvile, Ky., as announced in these columns last week, is forty-three years old, and has had ten years' experience in the business. He has been vice-president and general manager of the Eastern Pennsylvania Power Company, with headquarters at Easton, Pa. This company was formed two years ago, and operates plants in Easton, Bangor, East Bangor, Windgap, Portland and Stroudsburg, Pa., and Mount Tabor, N. J. Other plants are operated at Dover and Columbia, N. J. Mr. A. M. Worthington, whom Mr. Glidden succeeds Oct. 15, has been in the service of the Louisville Lighting Company for seven years, and has been in the business for the past twenty years. He is suffering from a tubercular trouble, and intends to seek a milder climate in the hope of securing relief.

Trade Publications.

LIGHTING FIXTURES.—The Delta-Star Electric Company, Chicago, is distributing a new catalog describing a full line of "Mazda" lighting fixtures for indoor and weatherproof service. Photometric curves are given by the use of which the proper reflectors can easily be selected for a given installation.

BELL SINGLE-PHASE MOTORS.—The Bell Electric Motor Company, Garwood, N. J., has issued a catalog illustrating and describing in full detail its line of high-efficiency single-phase motors. The points of superiority of the Bell motor are brought out in seventeen reasons why it should be adopted by central stations and industrial plants for power equipment.

MOTORS FOR INDUSTRIAL USE.—In a folder issued by the Mechanical Appliance Company, Milwaukee, Wis., the various types of Watson motors, in ratings ranging from ¼ hp to 30 hp, are illustrated and various applications to industrial problems suggested. Constant and adjustable speed direct-current machines for all standard voltages and single-phase, two-phase and three-phase motors for standard frequencies and voltages are obtainable in either horizontal, vertical or back geared type.

UNITY POWER-FACTOR SINGLE-PHASE MOTORS.—With this title the Wagner Electric Manufacturing Company, St. Louis, has issued a bulletin (No. 94) describing in detail its new type of unity-power-factor single-phase motor. It will be recalled that this new type of motor was formally announced at the New York convention in May of the National Electric Light Association. In addition to illustrations of the motor, both alone and as installed for work, there are a number of curves bringing out the unique characteristics of the machine.

AUTOMATIC TIME SWITCH.—The Hartford Automatic Time Switch Company, of 97 Warren Street, New York City, is inclosing its time switch in a new type of case. This is dust-proof and weather-proof, with a rubber-gasketed door equipped with a Sub-Treasury lock. The switch is a device by which electric current is automatically turned on and off at such times as the user desires, and requires no attention other than weekly winding. Special switches are furnished to meet unusual requirements. The switch is described in full in an attractive leaflet which the company is distributing.

DE LAVAL STEAM TURBINES.—"Steam Turbine Centrifugal Pumps and Other Centrifugal Machinery" is the title of a 32-page booklet or album issued by the De Laval Steam Turbine Company, of Trenton, N. J., illustrating and describing briefly the several lines of machinery manufactured by that concern, including single-stage turbines for driving machinery of all kinds and for rope and belt transmission; turbine-driven centrifugal pumps for water works, for general water service in industrial plants and for boiler feeding, hydraulic pressure work, etc.; velocity staged turbines without gears for direct connection to high-pressure blowers, centrifugal pumps, etc.; multi-stage impulse turbines with gears for driving large direct-current generators, fans, centrifugal pumps and other moderate or low speed machinery; multi-stage impulse turbines without gears in large sizes for direct connection to high-speed alternators; motor and belt-driven centrifugal pumps for all services and heads; multi-stage centrifugal pumps for all services and heads; multi-stage centrifugal air compressors and De Laval speed reduction gears for various services. The same company has also issued in pamphlet form a reprint of a paper by Mr. Francis Head on "Comparative Tests of Large Engine and Turbine-Driven Centrifugal Pumps."

BUSINESS NOTES.

MR. EDW. JUMONVILLE, secretary-treasurer of the Interstate Electric Company, Ltd., of New Orleans, since its inception in 1903, and Mr. Reynolds Yundt, of the same organization, are making arrangements to go into the electrical supply business in New Orleans.

TERRY STEAM TURBINES.—Mr. J. S. Cothran, of Charlotte, N. C., has been appointed the sales agent of the Terry Steam Turbine Company for North and South Carolina. Mr. Cothran's offices will continue to be at Charlotte, N. C., where he has long been identified with the trade.

THE REYNOLDS ELECTRIC FLASHER MANUFACTURING COMPANY has opened a branch office for the Pacific Coast and adjacent States in the Electric Building, San Francisco, with Mr. Henry F. Frosch in charge of the office. A complete stock of standard types of flashers will be carried for immediate deliveries.

THE ROBB ENGINEERING COMPANY, Ltd., Amherst, N. S., have recently sold heating boilers to the following companies: C. C. Young Company, Winnipeg, Man.; John Plaxton Company, Winnipeg, Man.; H. G. Hagen & Company, Amherst, N. S.; Gorman, Glancey & Grindley, Edmonton, Alta.; R. C. Thomas & Company, Calgary, Alta.

THE CONNECTICUT TELEPHONE & ELECTRIC COMPANY and the Connecticut Shock Absorber Company, of Meriden, Conn., have jointly opened up a new branch at 819-A Boylston Street, Boston, Mass., under the management of William A. Ellis, who was formerly sales manager for the Bi-Motor Equipment Company, of Boston. Mr. Ellis has been identified with the automobile trade almost since the start and is very well known by the trade throughout New England. The Connecticut Company will carry on hand in its Boston office a large stock for the accommodation of the trade.

SWARTWOUT OIL SEPARATORS.—The American Gas & Electric Company, Scranton, Pa., recently placed its third order with the Ohio Blower Company, Cleveland, Ohio, for a 24-in. Swartwout horizontal oil separator. Swartwout products have also been ordered for the following plants: Enid Electric & Gas Company, Enid, Okla., one 14-in. cast-iron exhaust head; Delaware & Hudson Company, Albany, N. Y., one 12-in. cast-iron exhaust head; Western Electric Company, two 8-in. horizontal receiver separators; Yost Electric Company, Toledo, Ohio, one 20-in. and one 30-in. rotary ball-bearing ventilator, and Lowell Gas Light Company, Lowell, Mass., three 36-in. copper rotary ventilators.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 19, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,003,416. REGULATOR; J. C. Barry, Schenectady, N. Y. App. filed Sept. 13, 1907. For boosters connected in series with secondary batteries.

1,003,430. SWITCH; R. Cawyer and J. D. Gates, Mercury, Tex. App. filed Jan. 14, 1911. Telephone switch for party-line circuits for cut-out.

1,003,431. SYSTEM OF MOTOR CONTROL; A. Churchward, New York, N. Y. App. filed April 9, 1909. Regenerative braking system of motor control for motor-driven vehicles using storage batteries.

1,003,453. MERCURY METER; E. S. Halsey, Nahant, Mass. App. filed April 22, 1908. The armature revolves in mercury.

1,003,455. ELECTRIC-ALARM LUBRICATOR; W. A. Hardwick, Memphis, Tenn. App. filed March 8, 1909. Sounds an alarm when the lubricator is exhausted.

1,003,456. ELECTROLYTIC APPARATUS; L. H. A. B. M. Hazard-Flamand, Boulogne-sur-Seine, France. App. filed Feb. 6, 1911. For dissociating oxygen and hydrogen. Has a gas-proof partition between the electrodes.

1,003,457. RETARDING MECHANISM; F. Heath, National City, Cal. App. filed Aug. 25, 1910. A flywheel, spring and cable for retarding the action of an electromagnet, as in railroad signals.

1,003,464. SYSTEM OF MOTOR CONTROL; L. Janisch and W Linke, Berlin, Germany. App. filed May 7, 1909. The field is automatically weakened upon a decrease of speed. To protect anchor windlass, etc.

1,003,465. ALTERNATING-CURRENT MOTOR; C. L. Kennedy, South Braintree, Mass. App. filed Dec. 13, 1909. Automatically cuts out the starting winding and impedance.

1,003,476. TELEPHONE SYSTEM; A. D. T. Libby, Elyria, Ohio. App. filed July 15, 1909. Intercommunicating system. Connects any sub-station to outside lines.

1,003,506. VARIABLE-RATE METER; W. H. Pratt, Lynn, Mass. App. filed April 18, 1903. The indications are proportional to the product of the watt-hours times the price, which varies with the rate of consumption.

1,003,507. ASTATIC WATTMETER; W. H. Pratt, Lynn, Mass. App. filed January 25, 1910. Two four-pole armatures are mounted on a shaft and two four-pole series fields are mounted in operative relation.

1,003,547. TRANSFORMER SECONDARY; E. Thomson, Swampscott, Mass. App. filed Aug. 5, 1909. Welding-work holders are mounted on hinges to avoid the usual sliding support.

1,003,586. VENTILATED FUSE PLUG; F. C. Curtis, Troy, N. Y. App. filed Jan. 19, 1911. A gas-pervious ventilating packing is interposed between the body and cap.

1,003,600. REGULATION OF DYNAMO-ELECTRIC MACHINERY; H. Guttinger, Baden, Switzerland. App. filed Jan. 16, 1909. An operating sector rolls over a set of resistance-connected contacts; an electrically-controlled rotatable member moves the point of the sector.

1,003,604. ELECTROLYTIC PROTECTION; A. S. Herrick, New York, N. Y. App. filed Oct. 2, 1909. To protect earth conductors from electrolysis by stray currents from other conductors.

1,003,633. INDUCTION COIL; J. McIntyre, Jersey City, N. J. App. filed March 21, 1908. Improvements on Patents Nos. 796,851 and 868,468. To simplify the adjustment of the contacts.

1,003,634. INDUCTION COIL; J. McIntyre, Jersey City, N. J. App. filed Oct. 24, 1908. A non-rotatable contact bar is movable bodily relative to the other contact

1,003,649. INDUCTOR GENERATOR FOR IGNITION PURPOSES; H. J. Podlesak and T. E. Podlesak, Chicago, Ill., and Morristown, N. J. App. filed Sept. 25, 1901. Supports the permanent magnets without perforations; adjustable generation period.

1,003,659. ELECTROPLATING OF WIRE-CLOTH; F. J. Root, New York, N. Y. App. filed June 2, 1911. A strip is passed in and out of the plating tank over rollers.

1,003,673. ELECTRIC FUSE; J. A. Tornquist, Davenport, Ia. App. filed March 29, 1910. Inclosed strip.

1,003,676. ELECTROTHERAPFUTIC DEVICE; J. B. Wantz, Chicago, Ill. App. filed Oct. 21, 1909. Produces a combination of sinusoidal and alternating-current waves and also a so-called surging current.

1,003,677. PUSH-BUTTON SYSTEM FOR DESKS AND THE LIKE; B. L. Weaver and W. R. Miller, Middletown and Pennbrook, Pa. App. filed Dec. 17, 1910. Signal circuit buttons are carried by the sliding panel or shelf.

1,003,746. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed Jan. 28, 1909. A direct-current generator is mechanically driven by an induction motor, and supplies a storage battery and load circuit.

1,003,747. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed Dec. 10, 1908. Booster and storage-battery system.

1,003,789. CONTINUOUSLY OPERATING HIGH-TEMPERATURE RESISTANCE FURNACE; V. Popp and A. Minet, Paris, France. App. filed Jan. 16, 1911. A protecting wall extends around the tank inside of the granular resistor.

1,003,799. PROCESS FOR THE ELECTROLYTIC DEPOSIT OF METALS; A. Rodeck, Milan, Italy. App. filed June 6, 1911. The cathode and article both move.

1,003,817. BRUSH HOLDER FOR DYNAMO; C. H. Smoot, Chicago, Ill. App. filed Dec. 14, 1906. Double spring pressed and pivoted. For high-speed turbine work, etc.

1,003,829. ELECTRICAL SYSTEM OF DISTRIBUTION; E. Van Wagenen, New York, N. Y. App. filed July 12, 1909. A regulating dynamo controls the division of load between a storage apparatus and a main source of energy.

1,003,830. SEWING-MACHINE ATTACHMENT; D. Wald, O. C. Britsch and M. Taigman, New York, N. Y. App. filed March 8, 1911. Detachable motor and controller support.

1,003,839. INDUCTION MOTOR; J. R. Wiard, Lynn, Mass. App. filed May 10, 1909. Squirrel-cage type with high and low resistance members on the rotor, which is automatically shifted after starting.

1,003,843. ROTATING COMMUTATOR; A. D. Williamson, Sheffield, England. App. filed Oct. 28, 1910. A divided ring surrounds the commutator parts to overcome centrifugal force.

1,003,862. HIGH-SPEED TROLLEY; A. H. Armstrong, Schenectady, N. Y. App. filed Sept. 3, 1908. The wheel carries resilient metal contact blades and is rotated by a motor.

1,003,881. TROLLEY; F. Criest, Butler, Pa. App. filed April 14, 1911. The wheel rotates and shifts laterally on a curved bearing pin.

1,003,882. ELECTRIC REGULATOR; S. Y. Culley, Covington, Ky. App. filed Dec. 23, 1910. Resistance elements are cut into and out of mercury.

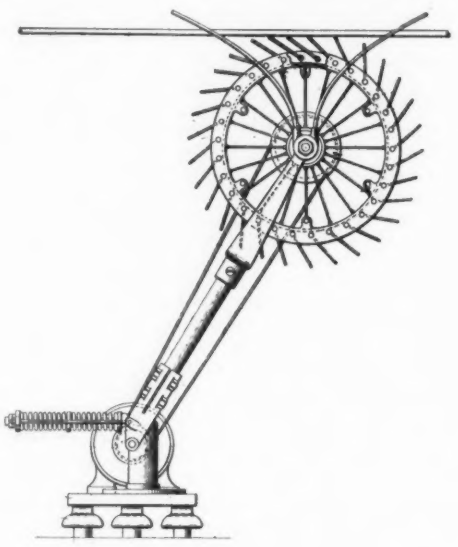
1,003,883. WATT-METER; C. R. D'Arcy, Wolston, Eng. App. filed Jan. 18, 1910. Alternating-current induction; potential and series windings.

1,003,890. TROLLEY AND TROLLEY SUPPORT; C. E. Eveleth, Schenectady, N. Y. App. filed Aug. 21, 1908. The collector is swung up and down by fluid pressure controlled by slight movements of the arm.

1,003,902. THREE-POSITION SIGNAL; L. A. Hawkins, Schenectady, N. Y. App. filed Nov. 7, 1908. A single magnet controls the motor for moving and holding the semaphore arm.

1,003,906. RESILIENT TROLLEY GUARD; J. P. Hopper, St. Louis, Mo. App. filed April 26, 1911. The guard is slotted for the wheel and supported by springs.

1,003,915. AUTOMATIC MOTOR STARTER; C. D. Knight, Schenectady, N. Y. App. filed June 10, 1907. A plurality of switches first connect the source with the motor through a transformer and then cut out the transformer.



1,003,862.—High-Speed Trolley.

1,003,919. DISTANCE-CONTROL SYSTEM; L. R. Krumm, Columbus, Ohio. App. filed Aug. 21, 1909. Two independent motors control the elevation and traverse of a searchlight.

1,003,923. METHOD OF MULTIPLE CONTROL; H. W. Leonard, New York, N. Y. App. filed Jan. 24, 1901. Commutator motors; train-control system, etc. Eighty-eight claims.

1,003,924. ELECTRICAL CONTROLLING MEANS; H. W. Leonard, Bronxville, N. Y. App. filed July 12, 1905. Alternating-current railway system for gradual and wide range of speed control. Sixty-two claims.

1,003,925. METHOD AND MEANS FOR CONTROL OF ELECTRIC ENERGY; H. W. Leonard, Bronxville, N. Y. App. filed Dec. 7, 1905. Speed variation by voltage control, direct current; aims to reduce size and cost of apparatus.

1,003,926. METHOD AND MEANS FOR CONTROLLING ELECTRIC MOTORS; H. W. Leonard, Bronxville, N. Y. App. filed March 16, 1906. Variable-speed control in direct-current systems, particularly train motors. Eighty-eight claims.

1,003,927. MULTIPLE-CONTROL SYSTEM; H. W. Leonard, Bronxville, N. Y. App. filed Jan. 24, 1910. Train system with three conductors. One hundred and eleven claims.

1,003,954. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Feb. 3, 1910. Pendant with two push-buttons and oscillating arm.

1,003,955. DYNAMO; L. E. Underwood, Lynn, Mass. App. filed Jan. 14, 1909. Arrangement of the field and connections for producing a constant output.